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The IRON AGE

Vol. 161, No. 12 March 18, 1948

Editorial

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Technical Articles

o o o

Features

o o o

News and Markets

o o o

Here's Coast-to-Coast Service on Alloys

When you contact a Ryerson Plant for alloy steel, you're actually contacting all twelve plants in the Ryerson Steel-Service system. That means when the alloy you need is temporarily out of stock at the point of purchase, the huge stocks of eleven other Ryerson Plants are promptly checked to find the steel that meets your requirements. And it means that vast and varied Ryerson alloy stocks are within easy reach, no matter where you are in America.

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Double Standard

THE leaders of the steel industry are in the public stocks. A barrage of lampoons, cartoons, invective, editorial indignation and political denunciation is directed at the heads of steel leaders—the offense a 10% increase in the price of semi-finished steel.

It was unfortunate that the increase was announced in the midst of tumbling farm prices, when inflation and its control were front page news. The public was extremely sensitive to high prices. The party in power had already selected inflation as the leading issue of the campaign. Although itself largely responsible for the sharp rise in the price of food, the Administration—with some success—had found other scapegoats which it was belaboring in public. Into this sound and fury of political flagellation the steel industry stumbled with a minor price increase which the press seized avidly and described with two odious words—"inflation" and "monopoly."

Nothing illustrates more effectively the double standard of economic conduct which "progress" and the new liberalism have introduced into American life. The increase in steel prices may prove to be largely an intra-industry adjustment. In any event, its ultimate reflection in prices at the point of final consumption will be insignificant. This and the fact that the particular categories of affected steel had been losing money for the producers will hardly stay the zeal of political inquiry or temper the venom of critical comment.

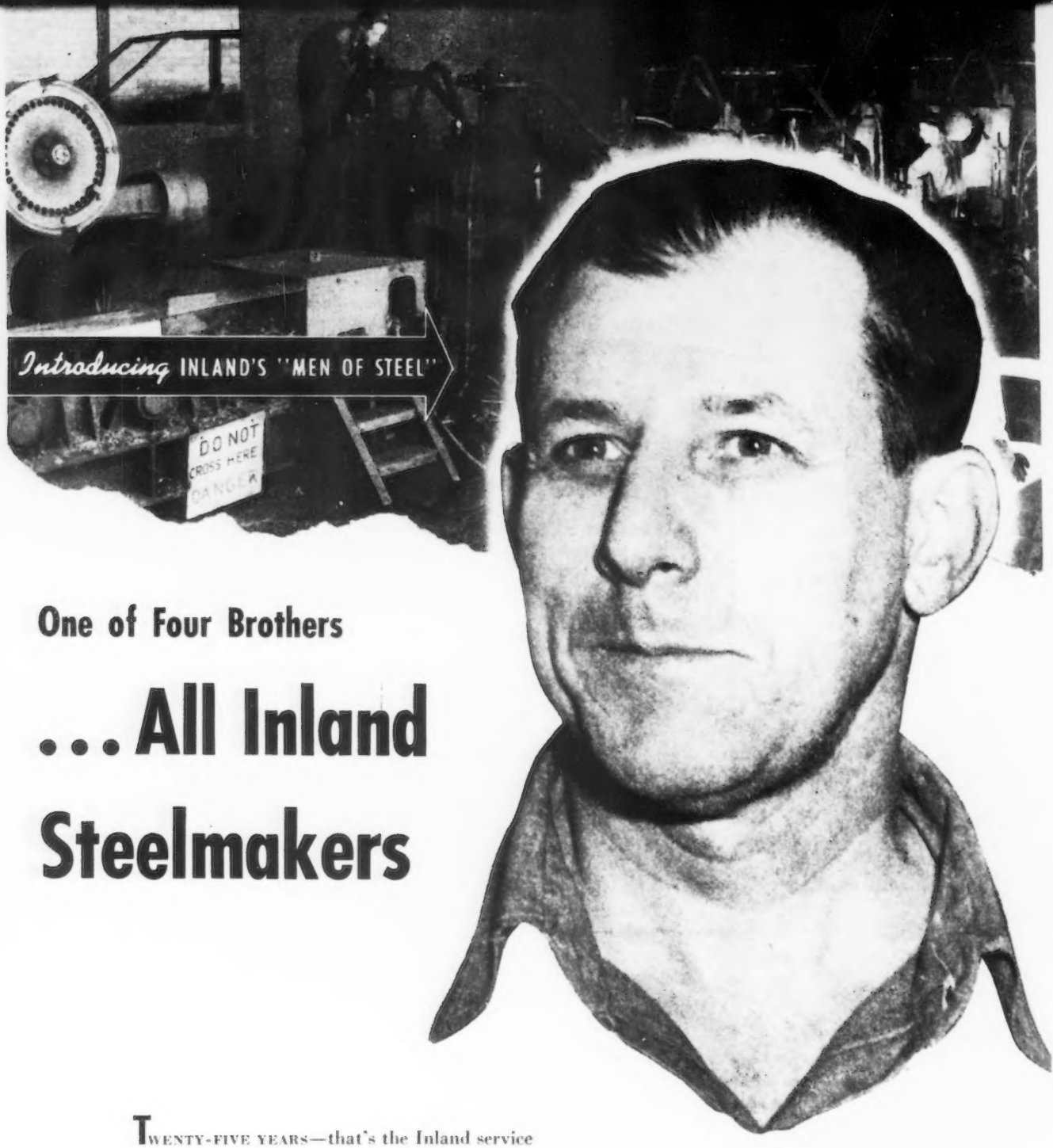
Anglo-Saxon justice has always prided itself on the equal treatment of all offenders. To have a schedule of penalties for the Greens which does not apply to the Blues is repugnant to the deep-seated sense of fair play which has always prevailed in American life. After a full month's decline, the price of wheat was still 261% above its August, 1939 level. After the recent "reprehensible" increase in the price of steel billets, they were still only 32% above the same level. Farm prices after the February drop were 196% above the level when Hitler invaded Poland, while the composite price of steel showed a total advance in the same period of 45%. An official agency of the government used hundreds of millions of taxpayers' money to push up the price of wheat. Individual farmers hoarded total harvests in order to get the highest possible price for the staff of life.

A comparative balance sheet of agriculture shows an increase from $4 billion to $15 billion in cash and $44 billion to $103 billion in net equity during the period 1940-1947.

In those areas which have produced in recent months the most painful price increases, the producer, the processer, the middleman and the retail merchant have charged all the traffic will bear. The gray market in steel reflects the failure of the steel producer to do likewise. He is not and has not been charging what the traffic will bear.

No one begrudges the farmer this welcome change in his status, nor should anyone question his right to sell his produce for the best possible price; but where in morals or economic principle can any honest reason be found for meting out one treatment to a farmer and another to a steel producer? How can the conduct of one be praised, when the same conduct in the other is condemned? Why should the exercise of ordinary business sense leave one a respected citizen acting within his clear rights, while the other becomes a sinister malefactor abusing his power?

Joseph Stagg Lawrence



One of Four Brothers

...All Inland Steelmakers

TWENTY-FIVE YEARS—that's the Inland service record of Fred Green, Jr., skilled roller on Inland's 24" Mill.

Add 24 years more for brother Ralph, assistant superintendent of Plant 1 Mills; 19 for Albert, first ladle-man in the No. 2 Open Hearth; and 14 more for Raymond, roll-hand in the 44" Hot Strip Mill. Your total will read 82! That points to a lot of steelmaking know-how. So does the fact that nearly half of all Inland employees have been with the company 10 years or longer. Both records mean something more, however. They tell a story of *job stability*... a vital factor in Inland product quality.

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► Before the end of this year the good news to flat-rolled steel users will be that the industry will knock out 20 million tons of sheet and strip steel. In 1947, 18.3 million tons of hot and cold-rolled sheet and strip were shipped. But December production was on the basis of an annual rate of 19.3 million tons.

By the end of 1948 the steel industry will be able to make 21 million tons of sheet and strip. This will be an all-time high.

► Managers of other steel products such as tinplate and plate will have to watch their supply of semifinished steel this year if sheets and strip are not to take a bigger load. Expansion in hot and cold-rolled facilities will take a much bigger chunk of steel than they ever have. It will take time for ingot capacity to catch up.

► Aluminum producers have recently increased base and extra prices on sheet and plate. Although mixed with a few price cuts, the overall effect is sharply upward, particularly on extras.

► Briggs engineers are using a new technique called "poke spot welding" where portable welders cannot be used. This method employs high frequency and high welding current, a light-weight "gun," a fixed electrode, a device for cooling the electrode and a means for surrounding the weld area with argon gas.

► Round carbide tools are being investigated by at least two companies, with both reporting excellent results on jobs where such tools can be used. One company, in turning an automotive differential part, firmly positions the carbide insert in the tool holder.

Another company, in boring a 14-in. steel ring, has used the fixed tool position and also the loose tool position. In the latter technique, the round is positioned for depth in the tool holder but not anchored so that it is free to turn in the tool holder. Round carbide tools have also been used in skiving.

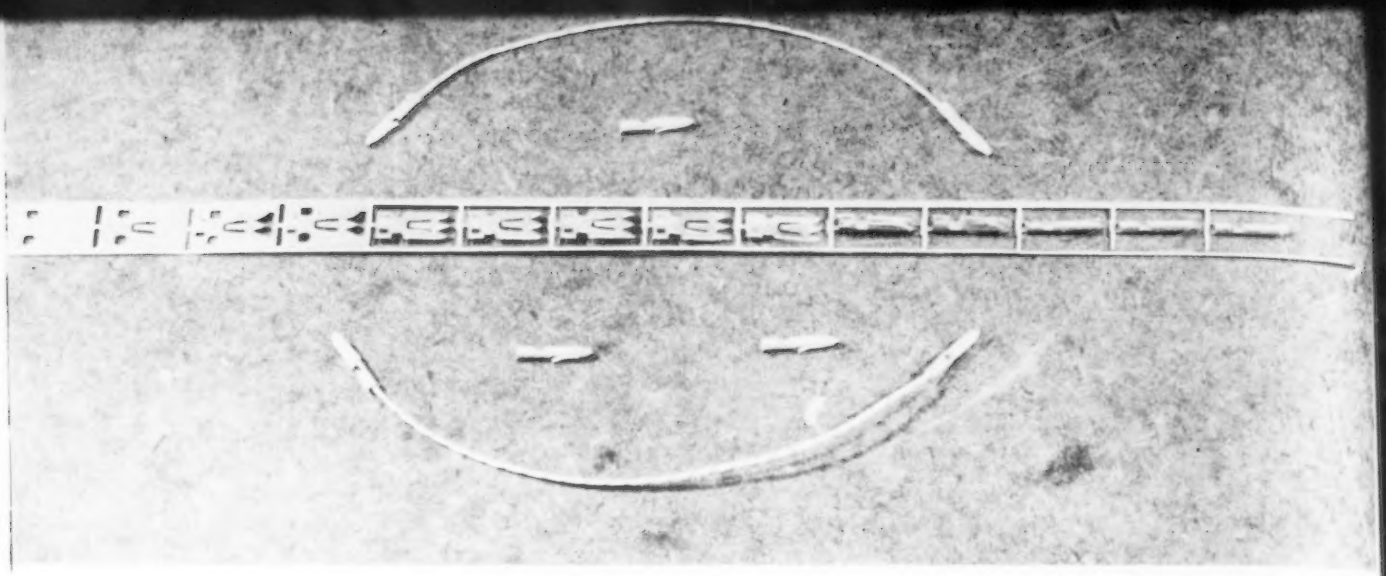
► Those car producers who have been buying heavily in conversion deals, getting their steel at high prices, may be able to do some price cutting, now that they are withdrawing from the conversion market.

► A producer of hydrogen reduced commercial iron powder selling 3 to 4 tons per day has reduced the large quantity price to 13¢ per lb. This producer is about to enter the electrical core market with hydrogen reduced iron powders designed to sell at 16¢ to 55¢ per lb.

► To determine whether poor dies or inferior steel are responsible for high production scrap, Ford engineers scribe a series of 1-in. squares on the blank prior to drawing; elongation in various areas on the formed part using the new dies is then determined. The same test is repeated when scrap runs high in production and the results are then compared with the original test.

► Sales executives are privately conceding that the markets for many items have softened. It would not surprise many observers if the recent 30 pct cut in tire production by Goodyear and the abandonment of second shift operations by Kaiser-Frazer is followed within the next three months by contractions in production schedules of motor cars by certain producers. The alternative appears to be price cuts.

► Considerable selling effort is required to move new cars at today's prices. In the case of one postwar car, it is reported that on an average 11.9 customers now have to be called to sell the car. A few months ago the ratio was 3.7.



These brass electrical circuit terminals, 0.937 in. long and 0.155 in. diam, are stamped on the U.S. Multi-Slide machine shown in fig. 2 on the opposite page. A motor-driven reel feeds stock into the machine and a microswitch, lower right of fig. 2, gages feeding stock for thickness.

High Speed Stamping of

WHERE stamped parts of complex shape are required in huge quantities, considerable investments in tooling are justified, even though development work is required to produce the dies needed and to make them function. This applies to three small parts, performing important functions in products manufactured by the International Business Machines Corp., at its Endicott, N. Y., plant.

Two of these parts are plugs employed as electric wire terminals for plugging in circuits. Both are made from strip brass because brass has the required properties to insure proper functioning, lends itself to rapid working in complex dies, and subjects the dies to as little wear as any material suited for the purpose. To insure good electrical contacts and high corrosion resistance, both brass plugs are silver plated before being assembled to mating parts, some of which are shown in fig. 1.

For the third part, called a terminal spring, the material is annealed beryllium copper strip coated both sides with cadmium. This copper alloy has high strength and unusual resistance to fatigue, making it a good spring material. Cadmium, applied to the surface as a die lubricant to reduce die wear, is burned off in heat treating the parts after forming. The hook-shape spring portion of the finished terminal acts as a plug that is pushed into a hole to complete an electrical circuit and the two tubes rolled in the body portion receive wires that are welded into place at assembly.

All three parts are for plugging in electrical circuits, providing barrels into which wares are secured. All have one portion acting as a spring element. All parts are stamped, since stamping lends itself to rapid production at lowest cost per piece, yet yields the required functional characteristics.

Although properly called stampings, since the parts are produced by dies from ribbon stock in press operations, the machines used are not the ordinary type of press commonly associated with stamping. U.S. Multi-Slide machines are employed in which the slides are actuated by cams on gear-driven shafts, two of which extend parallel to the die faces and the direction of the ribbon stock travel.

The stamping stock is purchased in coils and fed into each machine from a reel as shown in fig. 2. The reel has its own independent motor drive. Stock fed into and through the machine is controlled by grippers actuated by the machine and operated in such a way that the ribbon moves a precisely controlled distance prior to each die

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By HERBERT CHASE

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Through intricate tooling of U. S. Multi-Slide machines, a progressive die arrangement blanks and forms hard brass and beryllium copper strip into electrical terminals at rates up to 3 per sec, holding extremely close dimensional tolerances at critical points. Because of the complexity, tolerances and smallness of the parts, the forming technique described herein has provided a very economical high production method of producing these parts.

Electrical Terminal Plugs

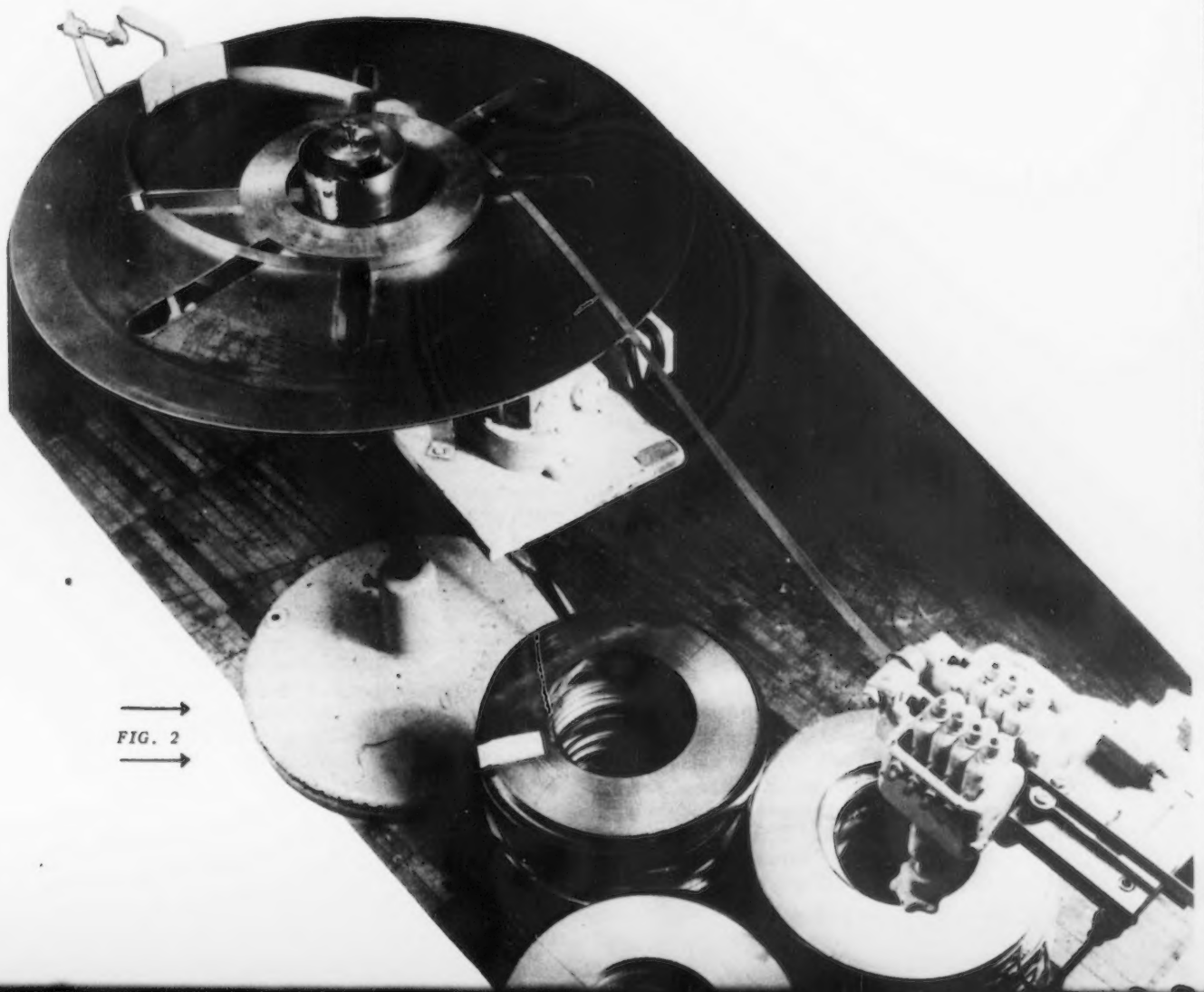

FIG. 2

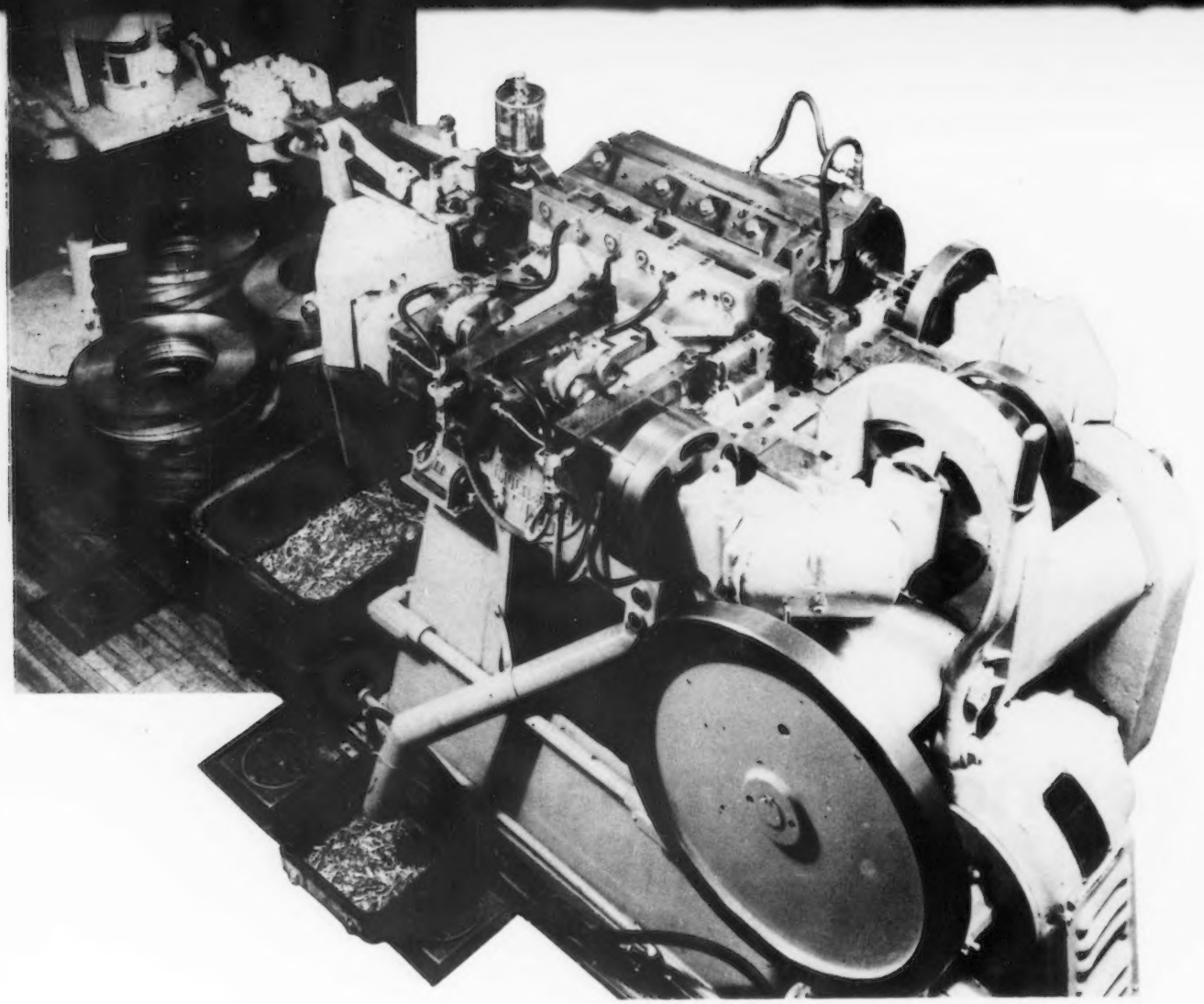

FIG. 3 - This Multi-Slide machine produces the short brass plugs shown in fig. 1. The die for this job is in place.

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closing. This is essential because the feed determines the correct indexing through the progressive dies.

Feed into the machine is through straightening rolls as well as through a system of levers that operate micro-switches, the function of which is to stop the machine automatically if the stock thickness at the gaging point is outside the specified limits. Cutting oil is fed automatically onto the ribbon before it enters the dies, helping reduce die wear and aiding in keeping die cutting edges sharp. This helps to produce clean cut parts within the specified dimensional limits, free from all save very fine burrs.

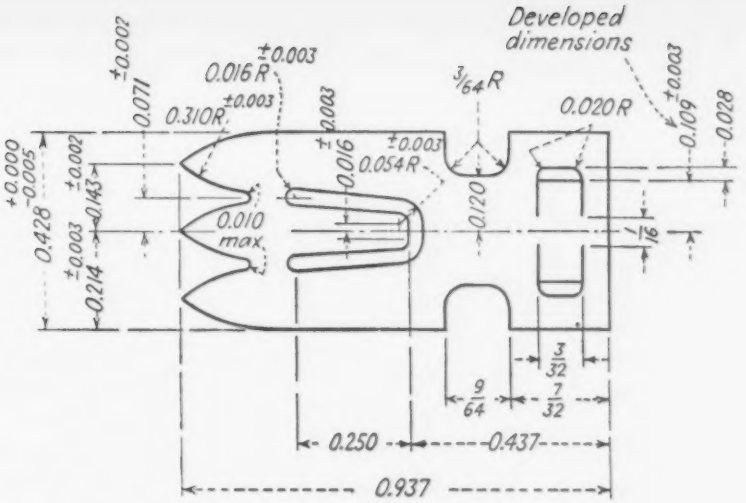
The dies are decidedly complex and involve numerous parts, many of which have more or less independent motion controlled by various slides which, in turn, are operated by cams on front, rear and end shafts. The front and rear portions of the dies are separated, when the ribbon stock is advanced horizontally (in a vertical plane) between the rear half and a stripper bar. Punches that pierce stock are on the front half of the die and are advanced far enough into mating recesses of the rear half to feed slugs through holes in the latter, out through the rear of the machine. Some punches that do piercing and forming are operated through the rear half with independent motion.

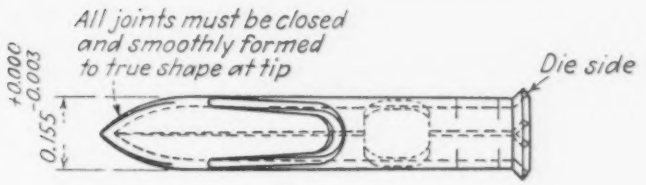
As dies are made in several sections and their parts are arranged to be moved by different slides, the motions may or may not be simultaneous. They can be varied to suit the operations they control, as long as the timing completes the motion before the part of the cycle involved must be finished. Thus, although the dies are progressive, some operations are controlled differently than in conventional stamping presses.

As all motions are short and are positively controlled in relative timing, high speed operations are possible and one finished part is cut off and ejected in each cycle of the machine. This

RIGHT

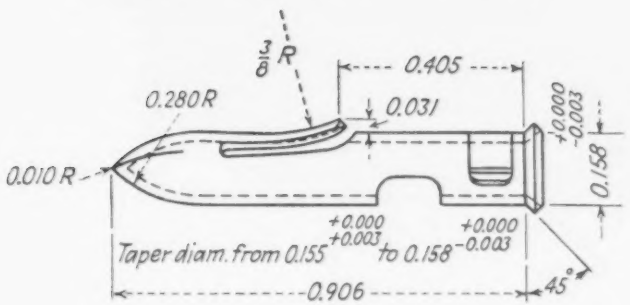
FIG. 4 - This drawing shows the details of the short brass plug as it appears in the developed blank and as completely formed.

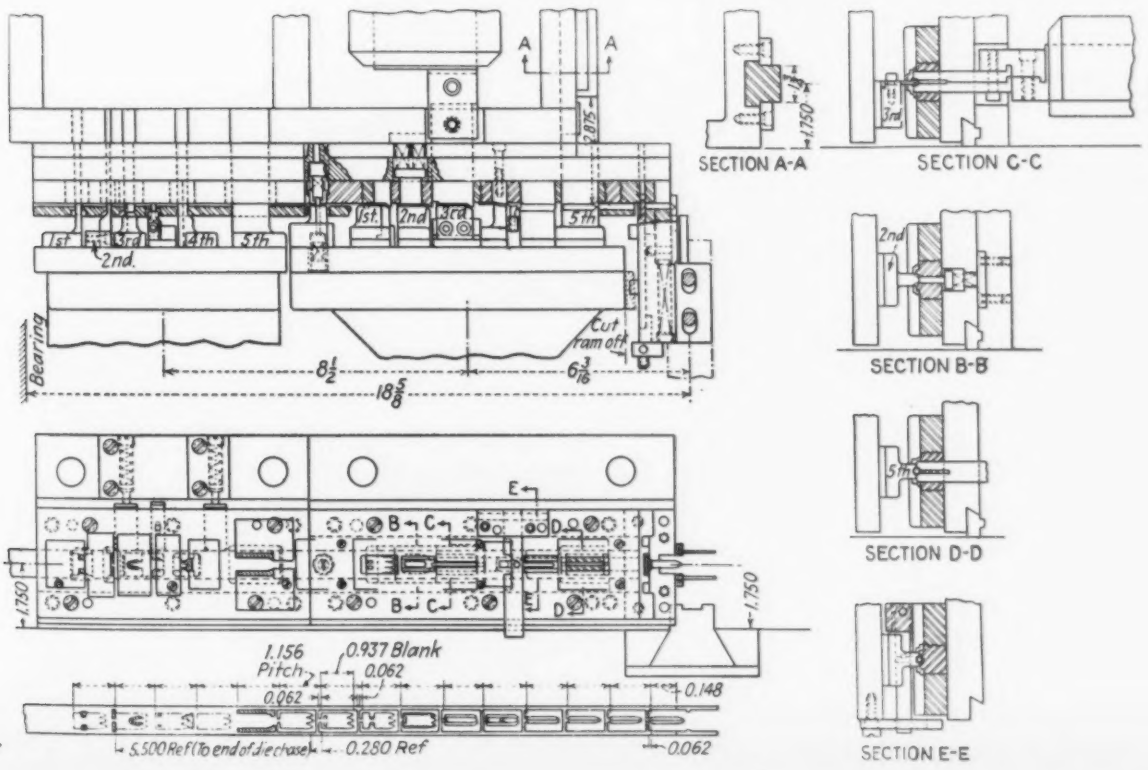




BELOW

FIG. 5 - The stamping stages of the short plug can be seen here, along with details of the dies used in its production.





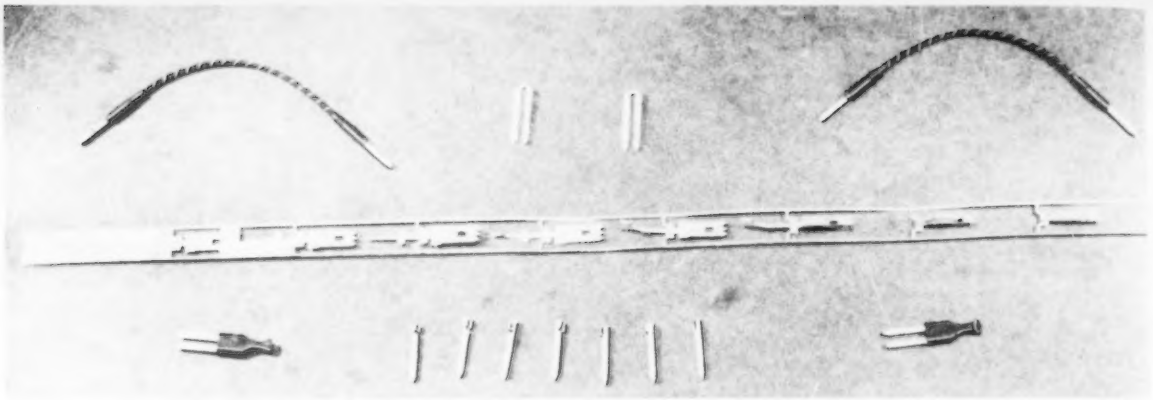
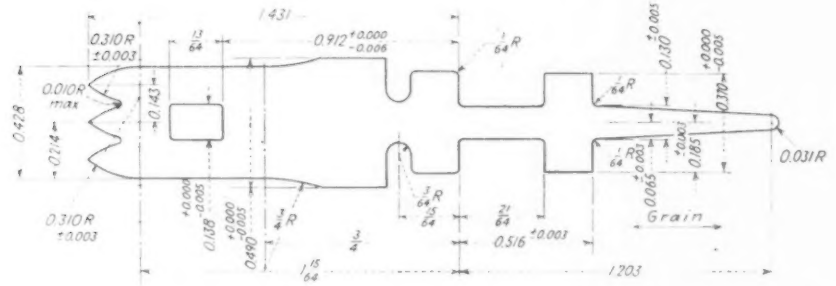
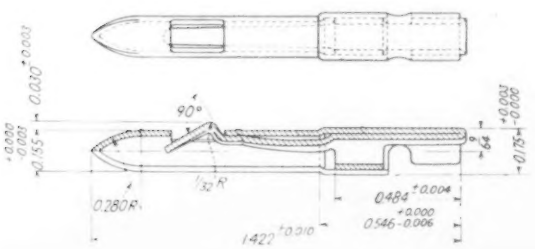


FIG. 6 - This strip of stock shows the successive stages in the production of the larger brass plug which is 1.422 in. long and 0.175 in. diam. Plugs are shown separately and also assembled to mating parts.



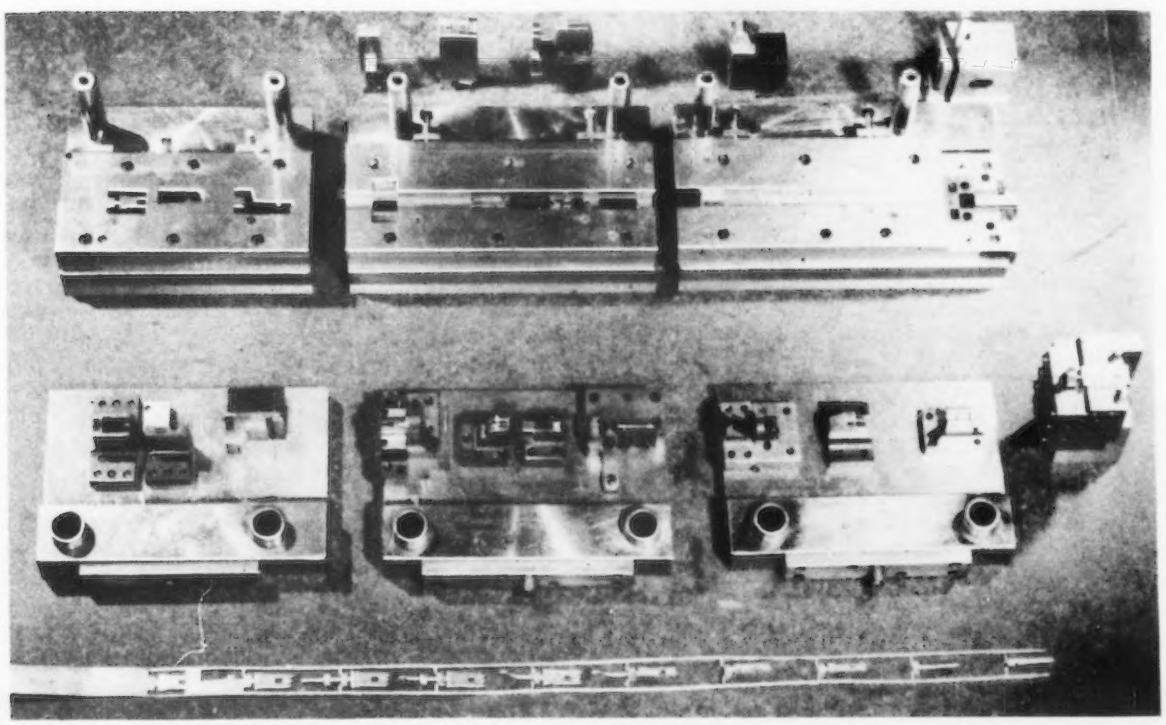
LEFT

FIG. 7 - Shown here is a detailed drawing of the large brass plug as blanked and formed showing how the spring prong folds back on the plug body making part of the plug double-walled.



BELOW

FIG. 8 - These are the dies for the largest Multi-Slide machine, as well as the progressive stages of stamping and forming the larger brass plug.



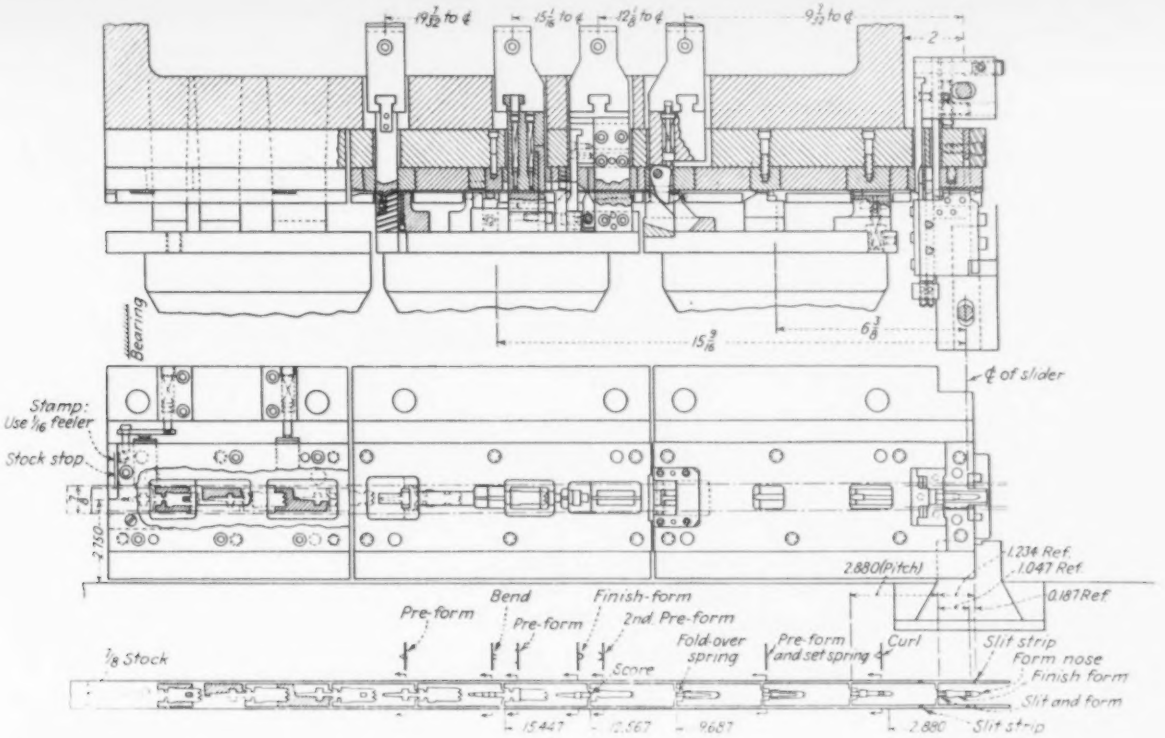


FIG. 9 - This assembly drawing of the die that produces the larger brass plug shows the strip (bottom) in successive stages and the latch (top) that folds the formed prong down into the partly formed outer tube of the plug.

machine is shown in fig. 3. Outer edges of the strip stock remain continuous, these unbroken edges being required to advance the work from station to station and to index each piece with reference to the die elements that perform the successive operations.

Fig. 4 shows details of the shorter brass plug, both as the developed blank and completely formed, while fig. 1 shows how the part appears in the ribbon in successive die stages. Fig. 5 details the die construction, showing the ribbon in successive stages. This plug is essentially a short tube having one end closed and pointed and the opposite end open and slightly flanged. Side walls are pierced to form a spring prong which, when the plug is inserted into a control panel, springs outward and locks the plug permanently into position. Before being so applied, however, a wire is inserted through the open end and is welded to the side wall at a point opposite a square opening that is cut to admit the small welding electrode.

The manner in which blanking and forming are done in progressive steps is apparent from a detail study of fig. 5. Originally, it was planned to form the pointed end by spinning. Its shape made the part difficult to hold, and spinning distorted the piece. Die forming of the points was tried and proved successful. Tips of the three points are formed at the eighth station and these

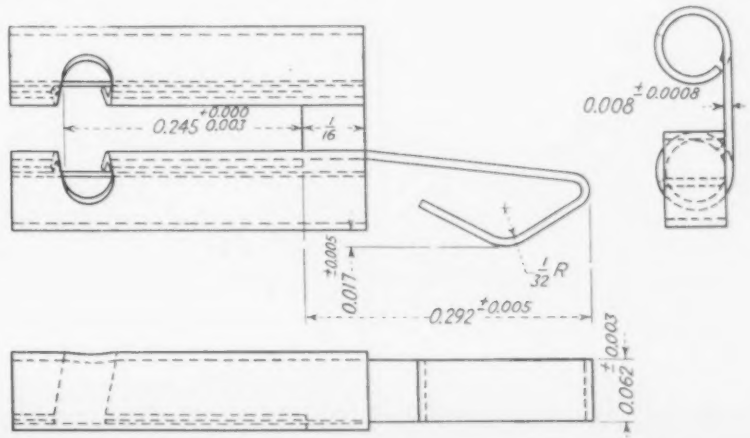


FIG. 10 - The double-barreled terminal spring shown detailed here is produced from cadmium plated annealed beryllium copper.

tips are closed in at the thirteenth station. Cut-off takes place at the fifteenth station and the part drops from the machine, completely formed, at the rate of 115 a min.

As the forming of this plug is not severe, it is made from extra hard brass, thus being sufficiently hard to give the prong adequate spring characteristics. Stock thickness is 0.019 in. plus 0.0013 to 0.0016 in., and it is $\frac{3}{4}$ in. wide. This allows for a continuous strip 1/16 in. wide at each side at the blanked part and leaves space for piercing out surplus stock between the blank and side strips, the blank being only 0.428 in. wide. From fig. 4 it will be seen that many dimensions are held between ± 0.002 and $+0.000 - 0.003$ in.

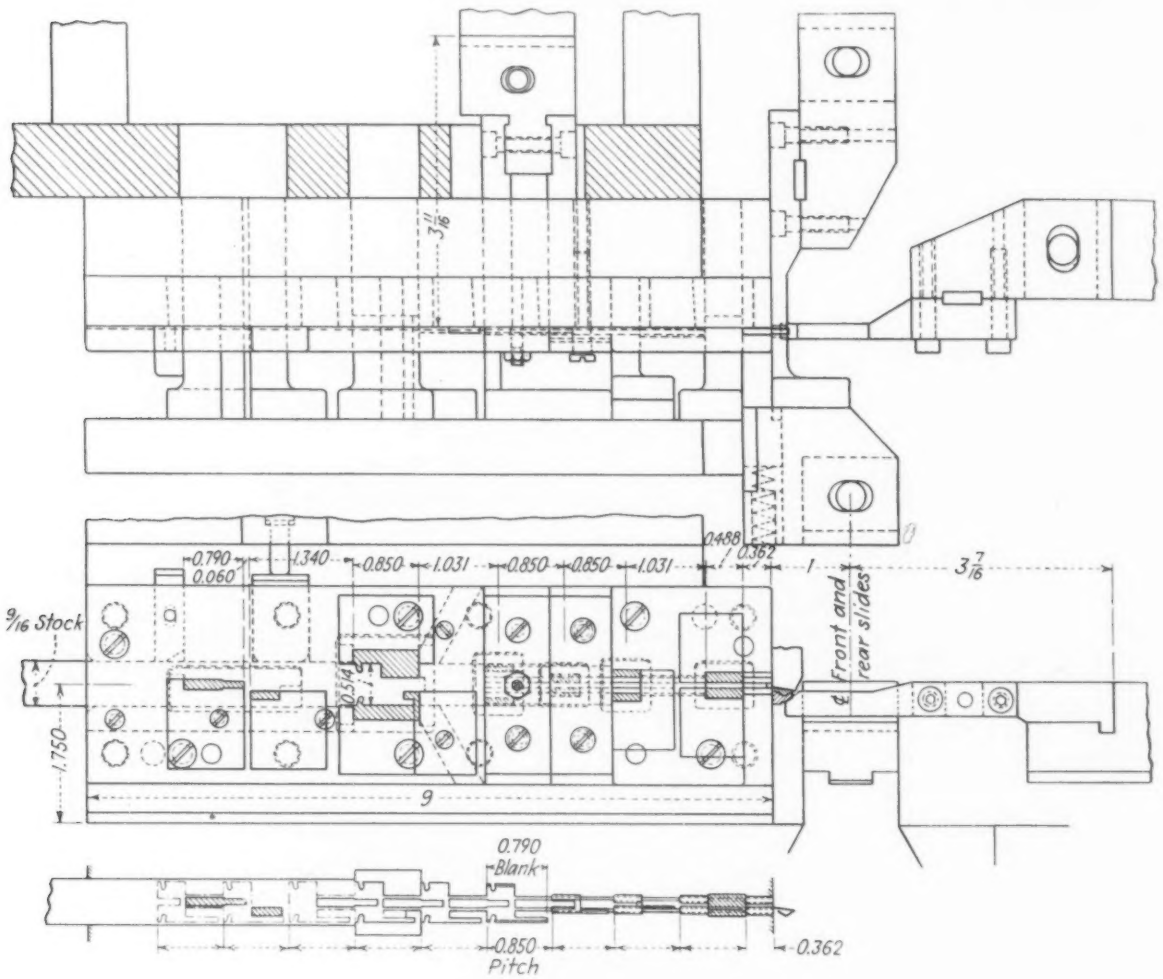


FIG. 11 - Assembly drawing of the die that produces the double-barreled stamping shown in fig. 10, having a projecting hook-shaped spring portion.

Long Brass Plug

Although the longer brass plug, shown in detail in figs. 6 and 7, has several points of similarity to the short plug, it constitutes a much more difficult forming job. It involves a prong that must be first formed to shape and work-hardened and then must be bent back 180° against the partly formed barrel, which is subsequently closed in around the tubular prong base to produce what, over a length of 3/16 in., is a double-walled tube.

This one-piece stamping is being run in regular production at the rate of 115 a min. This is accomplished in the same make and type of machine as that used in stamping the smaller plug, but one of larger size, having eight slides of which four are operated by the auxiliary camshaft.

As the larger plug has to be bent back upon itself when the prong has been formed, it was necessary to employ half-hard rather than the extra-hard brass used for the smaller plug. However, because the prong has to exert spring action, it became necessary to work-harden this portion.

This is accomplished in the fourth stage of the progressive die, figs. 8 and 9, where the prong is formed with a double curvature, shown in fig. 7, and is subjected to work-hardening impact by the die. The result of this forming and work-hardening operation can be seen in fig. 8. In the same operation, a hump is formed near the outer end of the prong and, when the prong is later bent back, the hump projects through a hole

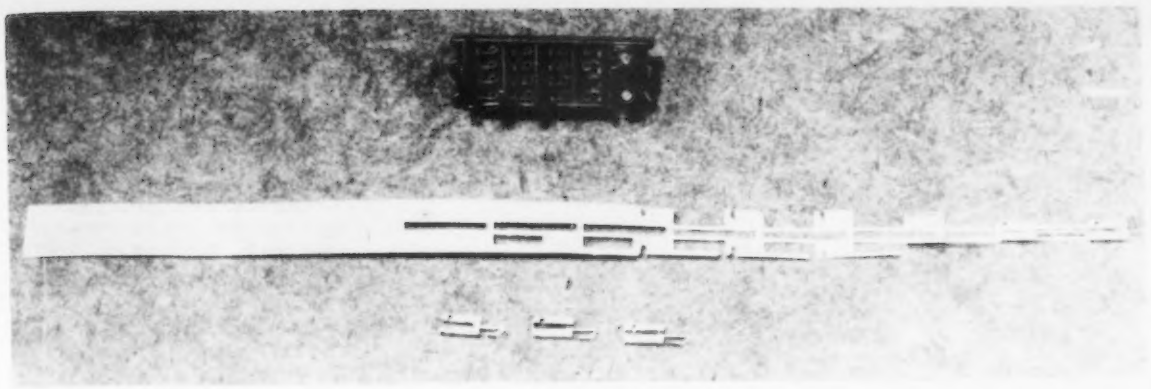


FIG. 12 - Double-barreled clips and the ribbon stock as pierced and formed in successive stages. In the background is a plastic molding into which the clips are inserted. Close fits into the holes are essential.

previously pierced through the part of the stamping that becomes the outer tube wall. The prong helps to make a positive spring contact when the plug is in position in the control panel.

Fig. 8 shows the dies used and plug in its production stages as well as in the shape it assumes when completely formed. Originally, the blank was made nonsymmetical about its long axis so as to avoid having the joints of the two tubular portions come in the same axial plane. This lack of symmetry, however, caused some distortion of the ribbon stock and interfered with proper registry so that the progressive die did not function satisfactorily. This trouble was avoided by using a symmetrical blank and it was found that there was no significant disadvantage in having both tube joints in the same plane. These joints are so nearly perfect that they appear only as fine lines with the gap nearly invisible.

Fig. 9 give details of the die construction and fig. 8 shows how the ribbon appears in successive stages of progress through the die. Blanking is completed in the first three stages and much of the forming and some curling are done in fourth, fifth and sixth stages. In the seventh stage, a latch operated by a pin is rocked about its pivot in such a way that the prong is bent down into the partly formed tube, and in the eighth stage the bend is flattened, bringing the prong into its final position.

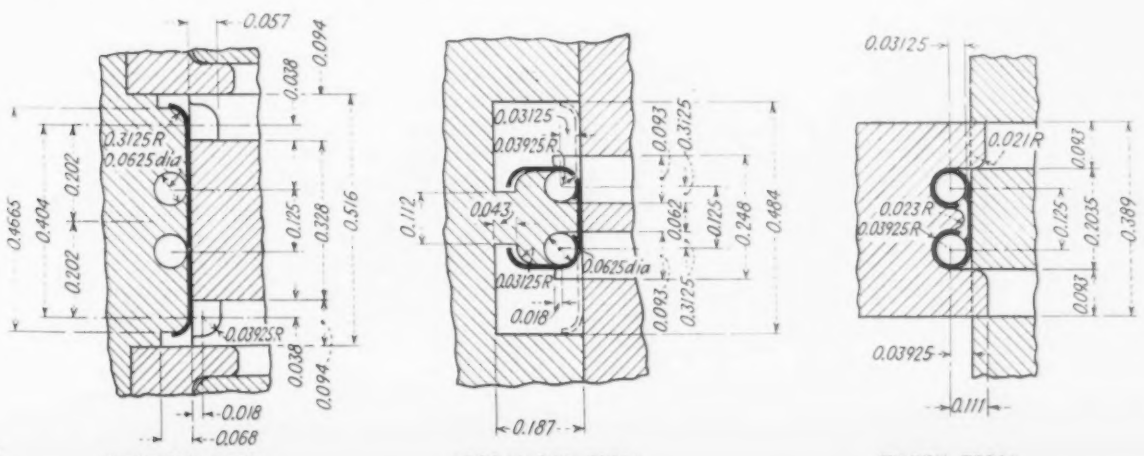
The tube is closed by curling in the ninth stage. In the tenth stage the nose and barrel are given their final form and the piece is cut off and ejected while the ends of ribbon side strips are slit and fall off, completing the operations.

Thus, by the use of a rather ingeniously designed ten-stage progressive die, a remarkable one-piece product is turned out at high speed. In no other way could a one-piece product of this design be made so rapidly, and it certainly is doubtful if equivalent results could be obtained with two or more pieces produced and assembled within comparable dimensional limits by other means. Critical dimensions are held within about the same limits as for the shorter brass plug.

Double Terminal Spring

Study of fig. 10, showing a double-barreled terminal spring, makes it clear that this small part, measuring only 0.6 in. in overall length, also requires superior tooling. Many dimensions are held within limits of ± 0.003 in. and the

FIG. 13 - Sectional view of parts of the dies that perform the curling operations on the two barrels of the stamping.



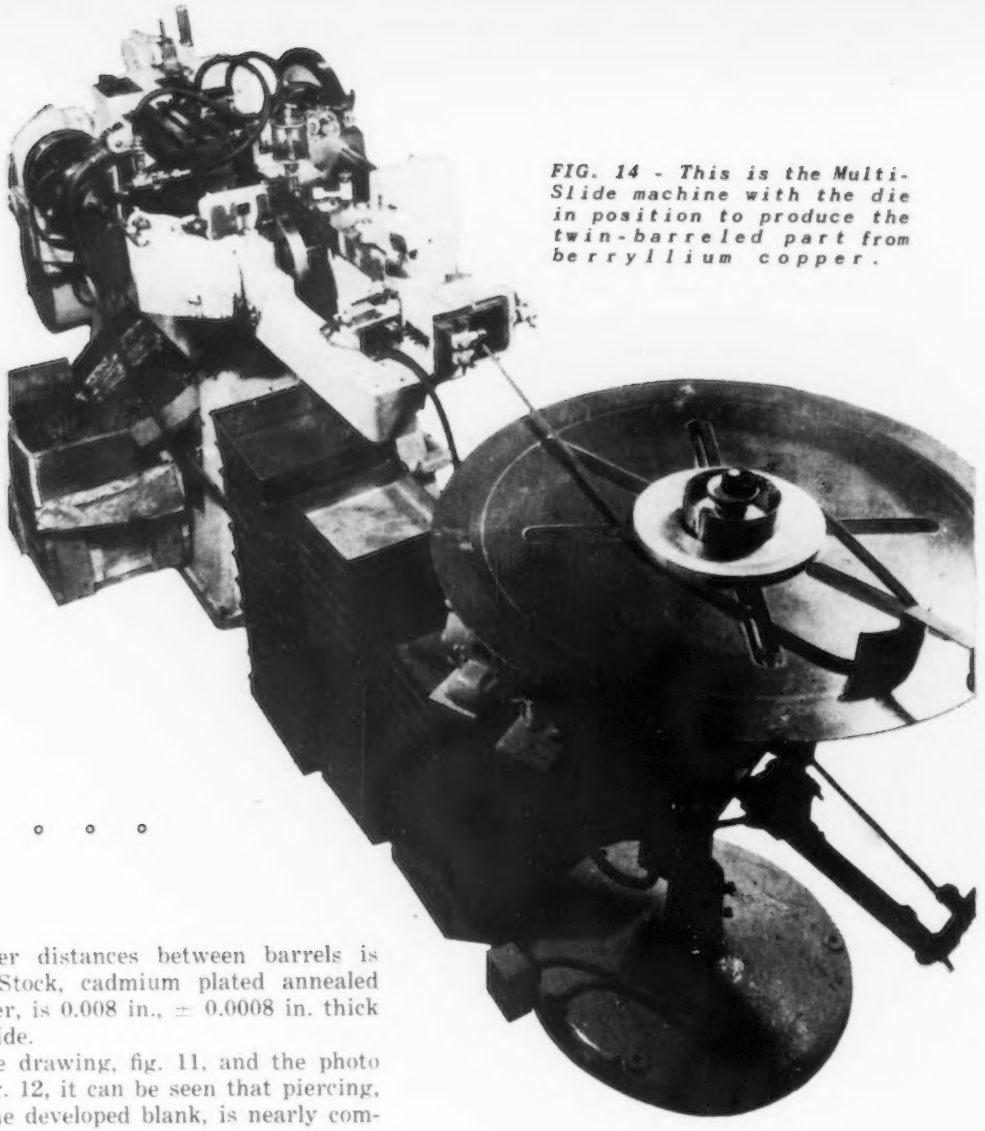


FIG. 14 - This is the Multi-Slide machine with the die in position to produce the twin-barreled part from beryllium copper.

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limits on center distances between barrels is ± 0.001 in. Stock, cadmium plated annealed beryllium copper, is 0.008 in., ± 0.0008 in. thick and 9/16 in. wide.

From the die drawing, fig. 11, and the photo of the strip, fig. 12, it can be seen that piercing, which forms the developed blank, is nearly completed in the first three stations. At the fourth station, however, punches clip off the flash at the outer edges of the ribbon, leaving narrow strips of flash nearer the center to advance the work to succeeding positions. At the fifth station, curling starts and is completed in the sixth and seventh stations. Sections through the dies at the three latter stations are shown in fig. 13, and fig. 14 shows the machine with the die in place.

To complete the piece, final curling is done at the eighth station and, at the ninth, the flat extension is formed into a hook. Since the bends of the hook are made parallel to the ribbon face or die parting, it is necessary to employ a forming tool actuated from the end and moving inward parallel to the die parting. This forming tool is actuated by a slide controlled by the cross camshaft at the end of the machine.

Forming is done by a vertical punch actuated by the same shaft, together with a split die having one section working from the rear slide and one from the front slide. Both die sections advance, then the vertical punch comes down to form the right angle bend. The end punch then comes forward part way to start the loop around both die sections. Then the lower die is retracted and further advance of the end punch completes the hook around the remaining die section.

At the final station, the piece is cut off and the strips of flash that have advanced the work to this point are clipped. This part is produced in the six-slide machine setup as shown in fig. 14, and the rate attained is 180 per min.

Following forming, the clips are degreased and oven heated to remove the cadmium coating. Parts issue from the oven at 550°F and are air-quenched to yield the hardness required on the spring portion. This spring part is designed to plug into a hole and complete an electric circuit after the barrel portions are inserted into mating holes in a plastic holder, shown in fig. 12.

Production of these parts, though now proceeding on a large volume basis, naturally was not attained without considerable development work on and many changes in details of die construction. It is necessary to keep dies in first class condition to avoid delays in the supply of parts to assembly departments. To keep machines busy, at least two sets of dies for each of the parts are maintained. This permits one set to remain in use while one undergoes such toolroom work as is needed to assure production of parts to the exacting specifications and inspection standards that must be maintained.

A Summary of

Heat Resistant Alloys From 1200° to 1800°F

One of the most comprehensive surveys of the high temperature alloy field ever completed is presented in this article. Conducted as a project of the Navy Bushipe, this summary correlates and evaluates the vast amount of scattered data on high temperature alloys disseminated over the past 7 years by various industrial and governmental sources. Particular attention is devoted to relative stress rupture data and creep properties at various temperature levels. In this, the first part of a three-part article, the authors list the compositions of some 53 alloys, together with physical property data for most of the alloys. A classification is also made of the different categories into which the metals fall, and some generalized observations are indicated regarding behavior among the groups.

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SINCE about 1940 under the impetus furnished by the war, an extremely large outlay of time, money and manpower have been expended for the development and improvement of alloys for service at high stresses and high temperatures. These alloys in the main are destined to be applied in gas turbines, jet engines and turbosuperchargers, but will find increased use in other directions as industry and the general public becomes more familiar with their overall properties. For example, in addition to having desirable high temperature properties, these alloys are extremely resistant to most types of corrosion and oxidation. There are probable surgical and dental applications, for example Ticonium and Vitallium.

From 1940 to 1947, many thousands of physical and chemical tests have been completed in the development and evaluation program, with the data summarized in a large number of reports. Some data for the same alloy appear in several reports or publications, making it impossible to evaluate the tests properly because of the diversity of heat treatments aging treatments, casting and forging variables listed. Even those who are intimately connected with the overall program are finding it increasingly difficult to thumb through the vast library of data to get at the heart of the matter.

Certain portions of this report have uncovered large gaps in the data; other portions are uncertain due to considerable conflict of experimental data. However, every effort has been made to include as much of the data as possible,

where the results were reasonably sound, keeping in mind, however, that some degree of brevity must be observed.

Thousands of individual alloys were made in the high temperature alloys program but only a limited number will be listed and discussed in this article. A great many showed sufficiently poor properties in the first tests at 1200° or 1500°F to be discontinued. Of this large overall group, there was a sufficiently large group of both forged and cast alloys which showed certain desirable characteristics to merit further testing. These are the alloys which are most familiar to persons concerned directly in the field. For the most part, there are about six or seven distinct alloy groups which will be discussed below.

These groups are listed in table I showing the more familiar alloy name, the NR number, where one is available, and the composition. In most cases the compositions are "aim" values, therefore nominal compositions. Where only one heat or casting of an alloy was made, the actual composition is listed, when it is available.

The nominal compositions are not correct because the cobalt contains 98.5 ± 0.3 pct Co with large impurities of Ni and Fe; the chromium metal contains 98 ± 0.5 pct Cr with Fe as the major impurity. Where ferroalloys were used, other impurities inevitably result. Thus, in the Co-Cr base alloys, up to 2 pct Ni and 0.5 pct Fe may be present but are not listed. Carbon contents are correct where they are shown in two decimal places, otherwise the nominal composition listed in table I may vary considerably. Changes of 0.1 pct C can and do cause large changes in the rupture and creep properties.[1] A knowledge of the actual carbon content is therefore very necessary if comparison of alloys is to be made from one melt to another.

Silicon and manganese appear in the alloys both as impurities and as intentional addition agents. The effect of manganese has been shown to be of considerable importance particularly in

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TABLE I

Names, NR Numbers and Compositions of Alloys

Alloy Name	NR Nos.	C	Mn	Si	Cr	Ni	Co	Mo	W	Others	Remarks
L-1Ts	1	0.3	0.6	0.6	13.9	33.2	10.8	3.5	2.3	Fe, bal.	Forged
H-418	3 & 44	0.4	1.5	0.6	15.4	24.5	25.1	3.3	2.	Fe, bal.	Forged
H-355	4	0.3	1.5	0.6	20.6	25.1	25.7	3.		Fe, bal.	Forged
H-439	6	0.4	1.5	0.6	20.4	29.6	31.3	6		Fe, bal.	Forged
S-495	8 & 34	0.5	0.7	0.9	15.	20.		4.	4.	Cb4, Fe bal.	Forged
Gamma Columbium	9 & 33	0.4	0.7	1.8	15.	24.		4		Cb 4, Fe bal.	Forged
Vitallium	10	0.2	1.	0.6	28.		64.	6			Cast
422-19	12	0.4	0.5	0.5	25.	16.	52	6		Fe 0.65	Cast
Timken 16:25:6*	15 & 49	0.1	1.5	0.9	16.	25.		6		N_2 0.07, Fe bal.	Forged
Refractalloy B	17	0.1	2		25.	30.		8		Fe, bal.	Forged
N-153	19	0.4	1.8	0.5	18.	15.	13.	3.	2.2	Cb 1, N_2 0.07, Fe bal.	Forged
N-154	20	0.3	1.6	0.7	16.	24.	21.	3.	2.2	Cb 1, N_2 0.07, Fe bal.	Forged
N-155	21	0.4	1.5	0.7	20.	20.	20.	3.	2.2	Cb 1, N_2 0.15, Fe bal.	Forged
N-156	22	0.3	1.5	0.6	16.	33.	24.	3.	2.2	Cb 1, N_2 0.04, Fe bal.	Forged
Nimonic 80	29	0.04	0.6	0.5	21.2	74.2				Al 0.63, Ti 2.4	Forged
8685-2	37	0.4	2.1	1.6	13.7	15.1	19.7	2.7		Cb 1.25, Ta 0.9, Fe bal.	Forged
8658-1	43	0.4	2.1	1.7	19.1	15.1	19.9	2.8		Cb 0.7, Ta 0.5, Fe bal.	Forged
S-497	45 & 2	0.4	0.5	0.6	15.	20.	20.	4.	4.	Cb 4., Fe bal.	Forged
19-9DL	46	0.3	0.6	0.7	19.	9.		1.3	1.2	Cb 0.4, Ti 0.2, Fe bal.	Forged
X-41	47	0.5	0.5	0.5	25.	8.	55.		7.5	CrB_2 1.8	Cast
ATV-3	51 & 67	0.4	1.4	1.2	15.	27.4			4.0	Fe bal.	Forged
N-153 (no Co)	52	0.4	1.5	0.7	16.	15.		3.	2.2	Cb 1.0, N_2 0.12, Fe bal.	Forged
N-155 (no Co)	54	0.4	1.6	0.8	21.	21.		3.	2.2	Cb 1.0, N_2 0.14, Fe bal.	Forged
N-155 modified	55	0.4	1.8	0.7	21.	21.		3.	2.2	Cb 1.0, N_2 0.12, Fe bal. Ta 1.1	Forged
TE	57	0.1	0.7	0.5	20.	30.		4.	4.	Ta 1.9, N_2 0.15, Fe bal.	Forged
61 (Cast)	60	0.4	0.3	0.6	24.		68.		6.		Cast
Refractalloy	62	0.1	2.	0.2	20.3	20.1	30.2	8.3	3.8	Fe 15.3	Forged
6059	63	0.5	0.2	0.8	26.	33.	34.	6.			Cast
X-40	71	0.5	0.6	0.7	25.	10.	55.		7.	Fe 0.6	Cast
X-50	72	0.8	0.6	0.5	23.	20.	40.		12.	Fe bal.	Cast
S-590	74	0.5	0.9	0.6	20.	20.	20.	4.	4.	Cb 4., Fe bal.	Forged
S-816	76	0.4	0.6	0.3	20.	20.	45.	3.	4.	Cb 4, Fe bal.	Forged and Cast
K42B	77	0.06	0.7	0.3	18.	42.	22.			Al 0.6, Fe 13, Ti 2.6	Forged
Discaloy	78	0.03	0.5	0.5	13.	25.		3.		Al 0.6, Fe 56., Ti 2.3	Forged
Co-Cr-Ni Base (9 Mo)	87	0.5	0.7	0.7	23.	19.	Bal.	9.		Fe 0.9	Cast
Co-Cr Base (9 W)	88	0.4	0.7	0.7	23.	3.2	Bal.		8.8	Fe 0.8	Cast
Co-Cr Base (9 Mo)	89	0.4	0.7	0.7	23.	2.9	Bal.	9.2		Fe 0.9	Cast
Co-Cr-Ni Base (5 Mo, 5 W)	90	0.4	0.8	0.7	22.6	18.2	Bal.	5.2	5.1	Fe 0.8	Cast
Refractalloy 26	93	0.03	0.7	0.7	18.	37.	20.	3.		Ti 3., Al 0.3, Fe bal.	Forged
Hastelloy B	94	0.05	0.6	0.2		65.1		28.6		Fe 4.7	Forged
Inconel X	99	0.05	0.5	0.4	14.6	73.4				Cb 1., Fe 6.9, Cu 0.04, Ti 2.3, Al 0.7	Forged
Stellite 6		0.98	1.0	0.7	32.		60.	0.6	4.6		Cast
GT-45		0.08	1.25	0.5	17.3	13.8		2.9		Cb 0.45, Ti 0.30, Cu 3.1, Fe bal.	Forged
MT-17		0.06	1.5	0.5	21.	30.	21	3.	2.2	Ti 1.6, Fe bal.	Forged
31V4		0.31	4.		23.		55.	6.			Cast
100NT-2		1.	1.5	0.5	20.	30.	20.	3.	2.2	Ta 2., Fe bal.	Cast
36VT2-3		0.36	2.		23.		65.	6.		Ta 2.	Cast
110N-2		1.10	1.5	1.	21.	30.	21.	3.	2.2	Cb 1., N_2 .07, Fe bal.	Cast
111VT2-2		1.11			23.		67.	6.		Ta 2.	Cast
73J		0.73	1.		23.	6.	60.	6.		Ta 2.	Cast
36J		0.36	1.		23.	6.	60.	6.		Ta 2.	Cast
35H		0.35	1.		23.	2.	61.	6.	3.	Ta 2.	Cast
CM 469		0.03			60.			25.		Fe 14.	Vacuum Cast

* This alloy has been designated as NR 14 in some of the OSRD reports.

Co-Cr-Mo base alloys.[2] The analyses listed in table I are of importance provided that the figures are accurate and are not merely rough estimates. The effect of silicon is not well-known in amounts up to 1 pct but is important when 2 to 4 pct is added.

Nitrogen, particularly in the forging alloys, is of great importance. Its effect in these high chromium alloys is quite large depending on the carbon content and the relative amounts of carbide or nitride-forming elements. Nitrogen is generally dissolved from the atmosphere up to about 0.06 or 0.07 pct by molten 20 pct Cr alloys unprotected by slags. Nitrogen can be added directly as an alloying element. It then has a similar effect to that of carbon; however, as the carbon content increases, there is apparently a decreased solubility for nitrogen.[1] Thus composition is important even with respect to the elements considered as unavoidable in these complex alloys.

As mentioned above, these alloys fall roughly into the following classes:

(1) Stainless steel types with somewhat increased alloy content, such as 19-9DL, Timken 16-25-6; they are essentially Fe-Cr-Ni alloys.

(2) Highly alloyed stainless steel types such as S-495, Refractalloy B; these also are essentially Fe-Ni-Cr alloys.

(3) Modified stainless types wherein cobalt is found in large amounts; these are essentially Ni-Cr-Co-Fe base alloys, such as N-155 or S-590.

(4) Stellite type alloys such as Vitallium, which was one of the first of this group: these are essentially Co-Cr-Mo or Co-Cr-W alloys.

(5) Modified stellite type alloys wherein certain elements are used in increasing amounts, notably nickel, tantalum, columbium, tungsten, carbon, etc., such as X-40, 73J, and others.

(6) Inconel, or Chromel or Nichrome types such as Inconel X and Nimonic 80. These are essentially Ni-Cr base alloys which can be made age-hardenable by additions of titanium, etc.

An additional group of considerable interest are the chromium base alloys such as CM 469.[3] These alloys are not considered to be practical alloys for the moment because of extreme brittleness, but may eventually be developed into extremely important high temperature alloys.

Table II lists the densities of most of the alloys tabulated in table I. The values, separated for the forged and cast alloys, are listed in the order of increasing density. In many applications, there is little or no concern over density but this property of the alloy becomes of great importance in all high speed moving parts where the centrifugal load is large, such as gas turbine rotor blades or buckets. For aircraft purposes, regardless of the application, weight is an extremely important factor. It is worth noting that there is an appreciable range of values among the alloys varying from about 8.2 g per cu cm for Inconel X and N-155 to 8.59 for S-816 and 8.61 for alloy X-40. The chromium base alloys are interesting in particular from this viewpoint because chromium has the very low specific gravity of 7.14. It could, therefore, result in a low density alloy system.

Table III lists the coefficients of expansion for most of the alloys. This list is fairly complete. There is one note of caution which must be added. All of these alloys are unstable dimensionally because of aging. Dilatometer

TABLE II

Density Values of Heat Resistant Alloys

FORGED ALLOYS

Alloy	NR No.	Density, G per cc	Alloy	NR No.	Density, G per cc
19-9DL	46	7.933	Nimonic 80	29	8.192
GT-45		8.01	Inconel X	99	8.3
Refractalloy B	17	8.022	S 495	8.34	8.260
N 153 (no Co)	52	8.038	N-155 (Hi C)	21	8.269
Timken	15.49	8.059	S-590	74	8.313
ATV-3	51.67	8.062	N-156	22	8.371
Gamma Columbium	9.33	8.084	Refractalloy	62	8.529
N 153	19	8.145	S-497	2.45	8.570
K42-B	77	8.152	S-816	76	8.587
N-154	20	8.189	Hastelloy B	94	9.24
N-155 (low C)	66	8.199			

CAST ALLOYS

Vitallium	10	8.298	61	60	8.542
422-19	12	8.314	X-40	71	8.608
6059	63	8.381	X-50	72	8.855
X-41	47	8.472			

TABLE III

Coefficients of Expansion* From 70 F to Temperatures Listed

Alloy	300 °F	500 °F	600 °F	800 °F	1000 °F	1200 °F	1350 °F	1500 °F	1600 °F	1800 °F
S-495			8.94	9.0	9.11	9.29		9.46		
Timken			9.28	9.29	9.36	9.52		9.69		
N-155 (L. C)			8.70	8.89	9.10	9.40		9.77	9.90	
N-155 (H. C)		8.5			8.7				9.9	
S-497			7.92	8.08	8.26	8.50		8.80		
19-9DL			9.31	9.59	9.78	9.97		10.01		
S-590			8.47	8.43	8.54	8.61		8.97	9.20	
S-816		7.6			8.0				9.4	
K42-B		8.0			8.4				10.0	
GT-45	9.17	9.47			9.93			10.52		
Hastelloy B			6.18	6.39	6.52	6.90			7.49	7.83
Nimonic 80			7.33	7.42	7.47	7.56			7.99	8.28
Inconel X		7.8			8.2	8.4	8.7	9.0	9.2	
Vitallium			7.83	7.96	8.18	8.38		8.68	8.72	8.90
61			7.64	7.96	8.18	8.48		9.24		
6059		7.6		7.74	7.98	8.14	8.4	8.6	8.76	9.03
111VT2-2						8.8	8.9	9.0	9.0	
100NT-2						8.5	8.8	9.0	9.0	9.3
422-19			7.70	7.86	7.91	8.07		8.42	8.54	
X-40				7.88	7.98	8.18		8.43	8.79	

* Values given in in. per °F X 10^{-6}

TABLE IV

Tensile Properties from 70° to 2000°F

Forged Alloys

Trade Name	NR No.	Temperature F	Tensile Stress, psi	0.2% Yield in psi	Properties Limit psi	% Elongation	% R. of A.	Treatment
LC N-155	66	Room	146,750	121,000	70,000	25.5	47	10% CW 1200 °F
		1200	116,000			13	23	10% CW 1200 °F
				0.1% Yield				
		1350	80,940	65,650		24	37	Hot worked
		1500	49,400	29,000		34.0	35.0	2300 °F—¾ Hr—WQ 1500 °F—4 Hr—FC
HC N-155	21	Room	138,000	70,600		16.0	12.6	2200 °F—1 Hr—WQ
		1500	58,000	29,000		34.2	28.8	1500 °F—4 Hr—FC
				0.2% Yield				
S-590	74	Room	160,500	89,500	30,000	10	10.5	2270 °F—1 Hr—WQ, 1400 °F—16 Hr
		1200	81,600	49,000**		27	31	2300 °F—1 Hr—WQ, 1400 °F—16 Hr—AC
		1350	66,875	58,500	22,500	27	33	2270 °F—1 Hr—WQ, 1400 °F—16 Hr
				0.1% Yield				
K42B	77	Room	162,500	97,200		31.0	39.4	
		1200	128,000	91,250		10.0	13.3	
		1350	101,000	79,700		6.5	10.2	1750 °F—2 Hr—WQ
		1500	71,000	41,250		2.5	4.2	1200 °F—72 Hr—FC
		1700	23,900			40.5	66.0	
Hastelloy B	94	Room	139,200	57,000		49.5	51.1	1950 °F—2 Hr—AC
		1500	77,500	42,500		27.0	21.2	1950 °F—2 Hr—AC
						48.0	41.7	
		1600	52,500	39,700		45.5	51.8	1950 °F—2 Hr—AC
	94	1700	39,000	28,400		62.0	53.5	1950 °F—2 Hr—AC
		1800	31,500	16,100		70.0	53.0	1950 °F—2 Hr—AC
		1900	18,500	9,800		54.5	46.9	1950 °F—2 Hr—AC
		2000	13,100	7,600				1950 °F—2 Hr—AC
				0.2% Yield				
S-816 Forged	76	Room	175,000	73,000		39	45	As rolled
		1200	120,200			17	22	2300 °F—1 Hr—WQ, 1400 °F—AC
		1350	98,900			15	22	2300 °F—1 Hr—WQ, 1400 °F—AC
		1500	78,260			12	21	2300 °F—1 Hr—WQ, 1400 °F—AC
		1600	59,770			18	20	2300 °F—1 Hr—WQ, 1400 °F—AC
		1700	46,180			14	17	2300 °F—1 Hr—WQ, 1400 °F—AC
Nimonic 80	29	Room	153,000	83,800	75,000	36.5	33.6	1950 °F—2 Hr—WQ, 1300 °F—16 Hr
		1200	97,500	77,000	30,000	14.5	20.8	1950 °F—2 Hr—WQ, 1300 °F—16 Hr
S-497	45	Room	154,750	138,500	57,500	10.5	25.5	Finish Forge 1400 °F
		1200	103,625	89,800	15,000	22	25.9	Finish Forge 1400 °F
				0.1% Yield				
		1350	64,400	36,000		35	32.0	2100 °F—1 Hr—WQ, 1500 °F—4 Hr—FC
		1500	63,400	40,400		6.5	8.6	2100 °F—1 Hr—WQ, 1500 °F—4 Hr—FC
		1700	28,000	16,000		19.5	18.4	2100 °F—1 Hr—WQ, 1500 °F—4 Hr—FC
				0.2% Yield				
Inconel X	99	Room	192,000	136,000		26	45	Hot rolled—aged
		1200	118,000			12	14	Hot rolled—Solution treated—aged
		1500	70,000			3	10	Hot rolled—Solution treated—aged
S495	8 & 34	Room	147,750	136,000	35,000	6.0	21.7	Finish Forged 1400 °F
		1200	87,625	72,200	37,500	24.0	34.3	Finish Forged 1400 °F
				0.1% Yield				
Gamma Columbium	9 & 33	Room	107,500	46,000		26.0	30.1	2250 °F—¾ Hr—OQ, 1500 °F—50 Hr
		1500	43,500	23,000		36.0	42.2	2250 °F—¾ Hr—OQ, 1500 °F—50 Hr
N-155	22	1500	55,000	30,000		32	33	2200 °F—1 Hr WQ—4 Hr 1500 °F FC
ATV-3	51	Room	121,700	84,000		21.5	36.5	As rolled
		1200	75,200	46,000		25.0	32.2	As rolled
		1350	60,000	30,750		28.0	39.4	As rolled
		1500	42,600	15,100		31.0	38.5	As rolled
		1700	24,100			39.5	43	As rolled
19-9DL	46	Room	140,750	115,000	75,000	29	48.1	2190 °F 1 Hr AC
		1200	91,000	81,000	52,500	16	38.8	Finish roll 1200 °F Stress relieve 1200 °F AC
Timken 16-25-6	15 49	Room 1200	162,250 107,500	143,500 94,000	102,500 60,000	15.5 13.0	33.6 27.9	2100 °F 1 Hr AC Finish roll 1200 °F AC Stress relieve 1200 °F AC
				0.1% Yield				
		1350	60,100	27,000		40.0	35.5	Preheat 1500-1550 °F, 2150 °F WQ
		1500	48,300	31,400		27.5	26.2	2160 °F 2 Hr WQ
		1600	21,000	12,000		22.0	19.5	2160 °F 2 Hr WQ
				0.2% Yield				
GT-45		Room	101,500	61,200	38,700	30.0	54.4	Hot rolled 1200 °F—5 Hr
		1200	66,500	47,500		27.0	48.2	Hot rolled 1200 °F—5 Hr
		1350	51,000	35,800	22,000	37.0	44.1	Hot rolled 1200 °F 5 Hr
		1500	36,000	24,000	15,500	19.0	16.7	Hot rolled 1200 °F 5 Hr

Cast Alloys

Vitallium	10	Room	110,000	65,000	55,000	10	12	As cast
		Room	120,000			5.1	6.6	1350 °F—48 Hr
		1200	71,000	35,600	25,200	18.4	41.5	As cast
			93,200	71,500	39,300	1.8	5.6	1350 °F—50 Hr
		1350	78,000	59,300	36,100	3.5	8.2	1350 °F—50 Hr
			82,700	63,700*	33,200	4.0	9.6	1350 °F—50 Hr
		1500	57,300	47,350*	23,300	8.3	19.7	1350 °F—50 Hr
			61,400	50,700	28,100	5.3	4.5	1350 °F—50 Hr

surveys indicate a shrink in the range of about 1200° to 1500°F, depending on the alloy. Once this aging phenomenon has occurred, no further dimensional change occurs which is not recoverable provided that resolution temperatures are not reached. It is important, therefore, to be sure that accepted values of the coefficients of expansion are on the aged material after all discontinuous changes have occurred.[4] It is presumed that the values in table III are for the stabilized alloy since most dilatometric tests are generally run in duplicate.

In all cases the coefficient of expansion curve is concave downward; that is, the coefficient increases with increasing temperature. The values are surprisingly similar for each of the alloy types, and only the high nickel alloys, Hastelloy B and Nimonic 80, are appreciably different.

The coefficients of thermal conductivity for

TABLE IV—Continued

Tensile Properties from 70° to 2000°F

Cast Alloys—Continued

Trade Name	NR No.	Temperature °F	Tensile Stress psi	0.2% Yield in psi	Properties Limit psi	% Elongation	% R. of A	Treatment
		1600	49,200	35,000	22,200	9.8	15.6	1350°F 50 Hr
			48,600	36,800	19,400	9.5	19.9	1350°F 50 Hr
		1700	42,470			27	52.4	As cast
		1800	33,265			35	52.4	As cast
			32,910			49	63.1	1700°F 16 Hr AC
6059	63	Room	82,550	46,900**		7	10.3	As cast
			76,800	41,100**		3	3.4	1700°F 16 Hr AC
		1200	46,300	34,400	24,200	3.3	7.7	As cast
			51,500	35,600	21,600	4.2	8.2	As cast
		1350		51,900*	30,600			1350°F 50 Hr
			66,200	49,800	32,100	3.2	4.6	1350°F 50 Hr
		1500	51,400	38,700	26,000	12.0	21.8	1350°F 50 Hr
			51,000	37,700	20,900	8.3	7.0	1350°F 50 Hr
		1600	41,500	31,200	13,700	10.0	20.8	1350°F 50 Hr
			41,200	30,500	19,500	13.0	19.4	1350°F 50 Hr
		1700	42,950			23	26.5	As cast
			45,430			16	34	1700°F 16 Hr AC
		1800	33,400			24	50.3	As cast
			33,690			26	41.7	1700°F 16 Hr AC
422-19	12	Room	98,100	55,100**		5	11.9	As cast
			94,500	56,200*		1	0.65	1700°F 16 Hr AC
		1200	58,300	36,900	19,500	7.2	15.7	As cast
			62,200	38,400	24,700	7.0	10.3	As cast
		1350	74,800	59,000	38,300	2.0	2.1	1350°F—50 Hr
			80,700	63,800	40,000	1.6	3.3	1350°F—50 Hr
		1500	65,000	49,500	29,400	2.7	3.3	1350°F—50 Hr
			63,000	45,700	23,700	3.3	3.6	1350°F—50 Hr
		1600	49,200	35,000	22,200	9.8	15.8	1350°F—50 Hr
			48,600	36,800	19,400	9.5	19.9	1350°F—50 Hr
		1700	45,180			17	26	As cast
			47,135			18	33.3	1700°F—16 Hr—AC
		1800	36,290			24	33.7	As cast
			37,800			21	38.7	1700°F—16 Hr—AC
61	60	Room	103,400	58,350**		7	11.2	As cast
			108,500	53,900**		6	14.2	1700°F—16 Hr AC
		1200	79,500	39,000	21,900	14.0	18.4	As cast
			103,400	74,000	37,300	2.1	5.8	1350°F—50 Hr
		1350	73,600	61,000	34,500	1.2	5.0	1350°F—50 Hr
			85,600	65,200	34,500	2.8	7.9	1350°F—50 Hr
		1500	59,500	40,000	23,900	7.4	16.1	1350°F—50 Hr
			57,500	41,200	25,100	8.2	9.3	1350°F—50 Hr
		1600	46,800	34,200	14,500	9.6	14.8	1350°F—50 Hr
			44,800	32,000	18,000	10.0	18.8	1350°F—50 Hr
		1700	37,475			7	35.7	As cast
			43,580			18	35.7	1700°F—16 Hr—AC
		1800	33,115			32	40.6	As cast
			33,050			27	39.5	1700°F—16 Hr—AC
X-60	72	1500	60,000	53,500	22,800	1.0	nil	1500°F—50 Hr
		1600	54,000	39,200	13,600	1.5	2.1	1600°F—50 Hr
			50,000	36,000	12,900	1.4	1.1	1500°F—50 Hr
X-40	71	Room	101,000	74,100		11	14	As cast
		1200	76,800	37,400	23,400	18	28.1	As cast
			77,300	37,800	22,500	20	28.6	As cast
		1350	82,200	53,400	31,300	7.0	8.1	1350°F—50 Hr
			69,200	53,800	33,100	2.3	7.0	1350°F—50 Hr
		1500	57,500	42,000	26,200	14.0	15.4	1350°F—50 Hr
			61,400	47,500*	32,400	5.0	12.1	1350°F—50 Hr
		1600	48,500	35,200	22,900	14.3	18.1	1350°F—50 Hr
			48,600	37,300	24,000			1350°F—50 Hr
31V-4		Room	136,300			3.3	6.0	1350°F—48 Hr
36VT2-3		Room	102,800			5.9	10.7	As cast
36J		Room	120,000			10.2		As cast
70J		Room	111,000			3.0	1.5	As cast
111VT2-2		Room	120,000			3.8	1.0	As cast
100NT-2		Room	100,000			1.5	1.0	2260°F WQ
S-816	76	Room	112,000	59,000		5	13	As cast

* Estimated
** 0.02 pct yield

most of the high temperature alloys are not available. Where the few measurements have been made, data are lacking on the accuracy of the readings. It is readily appreciated that these alloys are poor conductors but it would help in numerous calculations if the data were more complete in this respect.

Tensile Properties

It has been established in numerous high temperature experiments that tensile tests above the so-called equicohesive temperature are of little value. It is extremely misleading to interpret tensile data without supplementary long-time tests. Because of the role played by temperature, strain rate, and time, a tensile test at high temperature is quite insignificant. As a matter of fact, there is as much doubt about the value of a tensile test at room temperature on materials intended to operate at high temperatures.

Table IV lists as briefly as possible some of the tensile data from 70° to 2000°F for the high temperature alloys of table I. If all of the tests were included that are available in the various reports, this paper would be much too voluminous to read. Instead the effort was made to explain the values shown and discuss other treatments which result in higher and lower values than those shown.

It is readily appreciated that any stainless steel which is not heat treatable can be otherwise treated to show a wide range of tensile properties. Cold working to various degrees of hardness is perhaps the easiest means of effecting this change. So-called hot-cold working is still another way. Various solution treatments followed by aging are also effective in altering physical properties at low temperatures, provided the steel or alloy will be used at low temperatures. If an alloy is truly heat treatable, such as common steel, even greater changes may be affected.

By reheating up to or above the recovery temperature of the alloy the effects of cold work and hot-cold work can very readily be eliminated. By recrystallization even greater changes can be brought about. Increasing degrees of cold work effectively lower the recovery temperature.

Thus these alloys which are essentially austenitic in structure, containing varying amounts of carbides and nitrides, respond to most of the conditions discussed above.

Incomplete but undeniable evidence indicates that the recovery temperature of the cold-worked forged alloys is about 1200° to 1350°F, because cold worked test bars begin to lose their strength superiority over solution treated bars in that temperature range. Starting at about 1300° to 1350°F sufficient aging has occurred to obscure the picture of the exact behavior.

Accordingly, the particular treatments of cold working, etc., which yield the optimum tensile values from room temperature up to about 1300°F are not the treatments which yield optimum tensile or rupture or creep properties above 1300°F. It would thus be aimless to list all of the tensile properties which could be obtained and are obtained for the various combinations of treatment. Table IV lists some of the representative complete test results for various test temperatures and also lists the particular treatment which gave the alloy its properties. These values are neither the optimum nor the minimum values, and it must be realized that below about 1300°F many other values might be attained, especially among the forged group of alloys. Above about 1300°F the values listed generally are those for the alloy in its optimum condition for maximum rupture life and resistance to creep at the higher temperatures.

Among the cast alloys, especially the cast cobalt-chromium base alloys there is recent evidence that at temperatures as low as 1200° and 1350°F the usual as-cast, aged condition is not the most desirable for either long or short time strength. It is indicated that certain solution treatments are preferred for applications at these low temperatures, but these are not desirable treatments for high temperature performance.

While it is not desirable to generalize regarding behavior among these alloys, it has been clearly indicated that in the cast group of alloys the as-cast condition yields maximum room temperature ductility. Aging at the correct temperature results in increased room temperature strength with a corresponding decrease in ductility, which is of greater magnitude.

In essentially all cases, the alloys, after exposure to temperature, strain and time (resulting in aging and deformation), show decreased elongation values. Accordingly, tensile tests at low temperatures on structures which are not representative of the desired high temperature condition are highly questionable in value.

Furthermore it can be noted from table IV that the forged alloys show superior tensile properties at room temperature and 1200°F whereas the cast alloys show superior properties above 1350°F, indicating the inadequacy of tensile tests.

For more complete information on tensile data, the work by J. Freeman[5] is recommended as being by far the most complete for these types of alloys.

In a subsequent issue, the authors will discuss the factors that significantly influence rupture and creep properties.—Ed.

[1] *N. J. Grant, "High Temperature Alloys,"* THE IRON AGE, *May 23, 1946, May 30, June 6 and June 20.*

[2] *N. J. Grant, "The Effect of Composition and Structural Changes on the Rupture Properties of Certain Heat Resistant Alloys at 1500°F," Transactions, ASM, 1947.*

Parke and Bens, "Chromium Base Alloys," ASTM Symposium on Materials for Gas Turbines, June, 1946.

[3] *Grant and Lane, "Aging Characteristics of Gas Turbine Type Alloys," Bureau of Ships Research Memorandum No. 1-47 (Jan. v, 1947).*

[5] *Freeman, Reynolds and White, "High Temperature Alloys Developed for Aircraft Turbosuperchargers and Gas Turbines," ASTM Symposium on Materials for Gas Turbines, June, 1946.*

Vacuum Melting Techniques

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Rigid purity specifications, particularly with respect to contamination by non-metallic constituents, stress the importance of vacuum in the melting of many high temperature alloys and of metals such as tungsten, molybdenum, chromium, etc. Pointing to the influence of gases on the properties of metals, the author proceeds to indicate methods for the removal of these elements. Various procedures for degassing molten metal involving the use of carbon and hydrogen are described in this article and are evaluated from the standpoint of efficiency in gas removal. Problems usually encountered in vacuum melting work are touched upon and suggestions made as to overcoming these difficulties.

IN a discussion of vacua, it is important first to orient the reader as to the actual pressure involved when a vacuum is mentioned. Otherwise, it is somewhat like discussing high altitude without mentioning how high. Rohn, one of the pioneers in vacuum melting, dealt with pressures low on the millimeter scale. In this country today, vacuum melting is being done on rather large laboratory scales at pressures well under 100 microns and on smaller scales at pressures well under 1 micron. About 0.75 micron Hg is 1 millionth of atmospheric pressure.

The most obvious reason for the general use of vacuum melting in the laboratory is the high purity requirement of laboratory materials. In commercial alloys the low-quantity elements are classified either as impurities or alloying elements, depending on whether they are difficult to remove or are purposely added. In laboratory work all elements must be considered alloying elements whether purposely added or not. It is often the case that an element classified as an alloy actually has only an indirect effect by combining with and minimizing an otherwise effective impurity. In laboratory work all unwanted elements may be regarded as impurities, but because of the popular inference that impurities affect properties less than alloying elements do, it is more realistic to refer to all foreign elements as alloying elements. If it is necessary to differentiate, impurities may be called extraneous constituents, meaning undesired alloying elements.

If high-purity raw materials are used for melting, the primary extraneous elements are nonmetals—the gases of the atmosphere. It is necessary to allow metals to reside in the atmosphere, therefore even so-called high-purity raw materials include an oxidized surface which contaminates the metal. The surface of the melt in atmospheric-pressure melting is further contaminated by the gases in the atmosphere, primarily oxygen, nitrogen and hydrogen. Certainly, reduction in atmospheric pressure melting, even with the best slagging and deoxidizing methods, must be classified as crude when the primary interest is the acme of refinement as considered from the following point of view.

Gases influence the properties of metals in a manner similar to that of an alloying element. The influence is inherent whether the gases are dissolved or in the form of compounds. The degree to which metal properties are affected by normally gaseous elements is variable. Analytical difficulties in measuring small quantities of gases in metals are probably the reason for the limited gas-metal phase diagrams.

A great deal of qualitative evidence exists which shows unquestionable effects of the marked influence of oxygen, nitrogen and hydrogen. Probably the best known advantage of nitrogen is the hardening of steel by nitriding. Oxidation of metals is not usually considered alloying, but it actually is alloying to the extent of causing changes in the properties.

Metallurgists and engineers are becoming

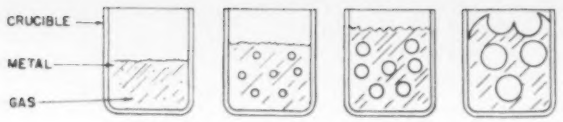


FIG. 1 - Schematic illustration of carbon monoxide formation.

more and more interested in the effects of very small amounts of oxygen in metals—not complete oxidation mentioned above, but below the degree usually considered in foundries—that which causes blowholes in castings. The gases in the latter case have a tendency to separate and occupy an isolated location as a blowhole. This is particularly true when gas solubility is markedly reduced upon solidification. If the solubility is high, the gases generally tend to remain either in solution or as compounds and to exert a direct effect on the structure and properties of the material rather than the indirect effect as physical macroscopic voids. It is, of course, possible that all three situations might exist; i.e. gases may be (1) retained in solution, (2) in the form of compounds, and (3) evolved in visible domains.

The marked influence of relatively incompatible atoms on the properties of metals, whether or not they are metallic, is well known. In general, the nonmetallic elements tend to be even less soluble in metals than relatively incongruous metallic elements. In other words, solubility tendencies of one atom with another tend to decrease as the relation or kinship is removed. The tools for measuring kinship are not complete, but the now obvious characteristics such as atom size, electron configuration, etc., tell a great deal about the relative character of elements.

The solubility of gases in commercial metals at room temperature is limited because gas atoms are incongruous and foreign to metal atoms and a metal cannot retain its inherent properties when associated with analytically-microscopic quantities of gas. In the field of fine, tailor-made commercial metals, the day is coming when techniques will be applied precisely to control gases in metals. In the field of research, gas control is dictated. Vacuum melting is a type of control, and in this article some techniques in conjunction with a vacuum system used for controlling gases in metals are discussed.

TABLE I

Gas Contents of Four High Purity Metals

Metal	Oxygen, Pct	Hydrogen, Pct	Nitrogen, Pct
Fe	0.061	0.0004	0.0018
Ni	0.006	0.0003	0.0000
Co	0.119	0.0001	0.0000
Cr	0.560	0.020	0.006

The oxygen, hydrogen and nitrogen contents of four high purity metals are listed in Table I. Various alloys of these metals, including tungsten and molybdenum, have been made. The experimental techniques discussed were employed in the manufacture of binary to sextary combinations. Each element exerts its characteristic behavior in vacuum melting, but objectionable traits, such as the high vapor pressure and

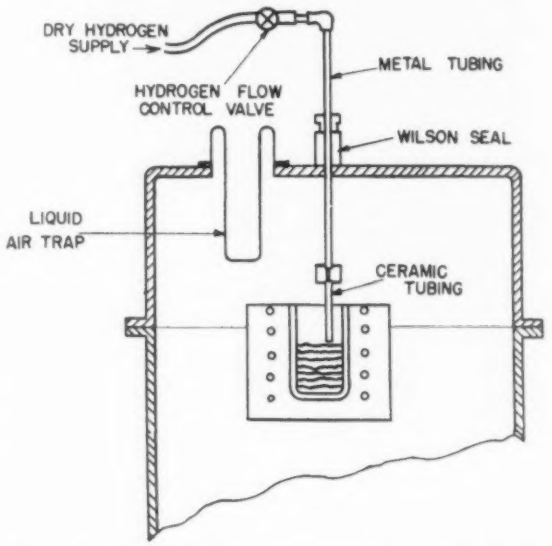


FIG. 2 - Schematic illustration of hydrogen bathing tube and liquid air trap.

affinity for oxygen possessed by chromium, are minimized to some extent when alloyed with metals such as cobalt or nickel, which are well-behaved in a vacuum system.

The equipment used for most of the experiment reported was recently described[1], but some sketches are included in this article to illustrate some of the recent modifications in the equipment.

The problem was not only to maintain the purity of the raw materials used, but also to further purify them to reduce the extraneous elements shown in table I. At the minimum pressure experienced (less than 1 micron), chromium oxidizes at high temperatures. Purity could not be maintained by low-pressure melting alone when active elements were involved. The pressure division between oxidizing and not oxidizing has not been completely determined for metals in the molten state. A little is known from observation and from the inherent affinity for oxygen which a metal possesses. Probably most metals oxidize at 1 micron in the molten state.

A second important factor must be considered. Molybdenum, for example, oxidizes rapidly at low pressure, but the oxide is very volatile and, provided the pumping capacity of the system is adequate, the oxide is at least partially removed as it forms. It is not practical, however, to purify molybdenum by vaporizing the oxide impurities at high temperature and low pressure for the following reasons: (1) The atmosphere, unless

[1] *J. D. Nisbet, "Producing High Purity Metals With Vacuum," THE IRON AGE, June 19, 1947, p. 56.*

purged with an inert gas at a partial internal pressure, is always oxidizing even at the best vacuum possible; (2) some oxygen is soluble in molybdenum in the molten state and this is a potential source of oxidation; and (3) physically trapped oxides will be retained in the melt.

For many years carbon and hydrogen have been employed to degas metal in vacuum-fusion analytical methods. Carbon is more commonly employed in the analytical method, while hydrogen is widely used to deoxidize metals in solid state purification. Carbon has been used in recent years as a deoxidant in vacuum melting. In view of this work, experiments were made using carbon and hydrogen for purification of vacuum-melted alloys. The two simple reactions involved are as follows:

$$XO + H_2 \rightarrow H_2O + X$$

$$XO + C \rightarrow CO + X$$

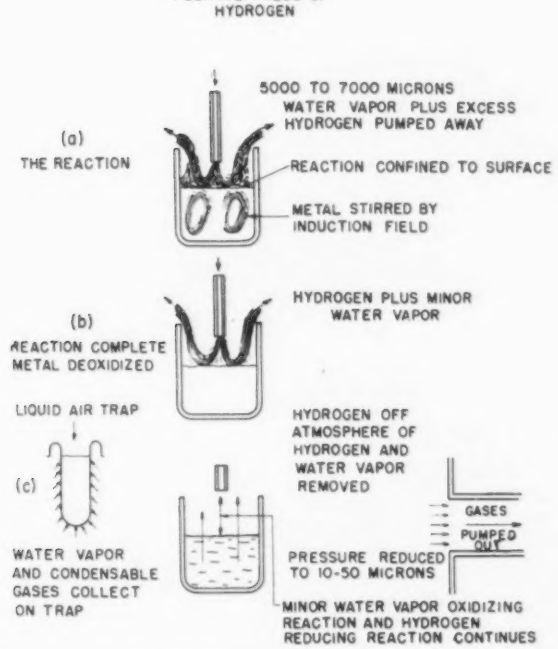


FIG. 3 - Reaction obtained when bathing the surface of the melt with hydrogen.

Degassing With Carbon

The evolution of carbon monoxide from molten metal caused during the carbon-oxygen reaction is enormous, as schematically illustrated as follows, by volume comparisons at a pressure of 100 microns and 1500°F:

0.001 l		0.0004 l		80,000 l		0.0005 l
XO	+	C	⟶	CO	+	X
(metaloxide)		(solid)		(gas)		(solid)

The problem involved with carbon reduction in vacuum then is the physical problem of controlling the large volume of carbon monoxide gas evolved from the metal. This condition is very much like submerging the nozzle of an air hose in the molten metal bath. The metal takes leave of the crucible.

A solution to this problem was sought by the techniques listed below which were designed to control the rate of reaction, i.e., the carbon boil, and to physically retain the metal.

(1) All carbon was added with raw material and vacuum melted at the temperature scheduled.

(2) Carbon was added under vacuum after melting in one, two, three and four equal parts.

(3) Carbon was added and dissolved at atmospheric pressure and the chamber slowly evacuated at a controlled rate.

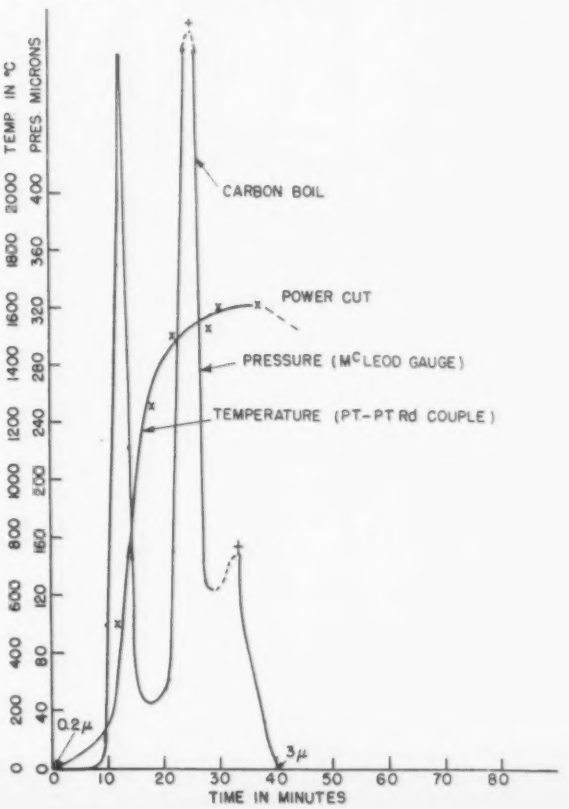
(4) Procedures (1) and (3) were repeated with physical retainers over the melt, such as (a) floated MgO powder, (b) floated MgO aggregate, (c) floated MgO plate, and (d) MgO plate covering crucible.

The alloys made during these experiments were ternary combinations of iron, nickel, cobalt, chromium, tungsten and molybdenum. The total gas content of each alloy was different; therefore, a different quantity of gas was involved with each melt. Enough similar melts were made, however, to evaluate the experiments.

A quantity, twice the theoretical amount of carbon required was used in all the heats made entirely under vacuum, while four times the theoretical carbon was used in the heats melted at atmospheric pressure to compensate for oxidation during atmospheric melting.

When all the carbon was added with the raw material, no visible reaction took place until the metal was melted and slightly superheated; then violent boiling would commence. Even alloys of raw materials having a rather low total gas content could not be consistently melted without considerable loss of metal (perhaps 20 pct of a 6-lb heat).

FIG. 4 - Typical pressure and temperature curves for an alloy containing 70 pct Ni, 30 pct Cr and 0.75 C.



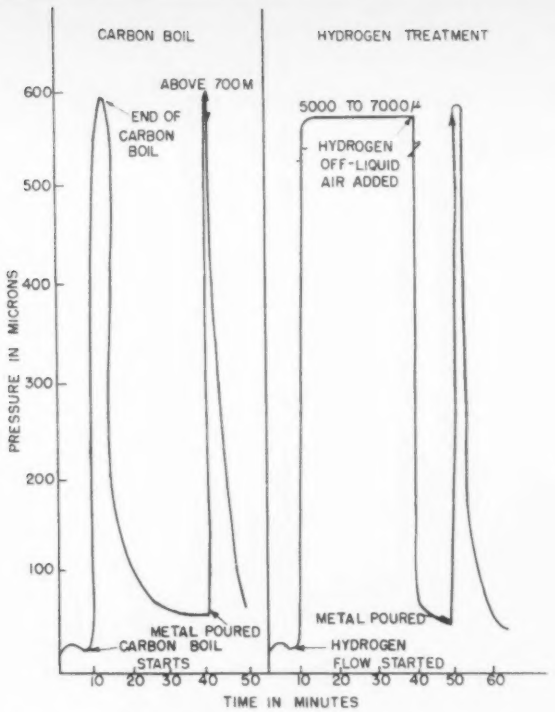


FIG. 5 - General pressure curves associated with large vacuum melting and casting machines.

Temperature was carefully controlled in an attempt to control the rate of the carbon reaction but proved to be a delicate operation and inadequate.

Carbon was added in small quantities equal to as little as one-fourth of the total amount, but again the space occupied by the carbon monoxide formed from extremely small amounts of the compact carbon and oxide was entirely too great to just bubble quietly at the low pressures and high temperatures involved. Even slow additions of finely-powdered carbon would no doubt bubble vigorously.

An attempt to control the reaction by controlling the pressure was tried. Heats were melted at atmospheric pressure and the carbon dissolved in the melt. While the metal was held molten, the pressure was gradually reduced. This method had the disadvantage of further oxidation during melting under high pressure conditions. Gases are evolved other than by carbon monoxide formation due to reestablished equilibrium conditions as the pressure is lowered. The natural evolution of gases due to a decreasing pressure caused quiet bubbling, provided the reduction in pressure was reasonably slow. At 2000 to 4000 microns, the carbon boil would start. Small increases in pressure would arrest the reaction and a reduction in pressure caused the boil to proceed rapidly. If the pressure was held, the boil would subside in a few minutes and start again by a further pressure reduction.

The pressure control method was an improvement but a tedious operation. The high degree of oxidation during atmospheric melting was a serious disadvantage.

The fourth series of experiments involved physical coverings over the melt. An MgO plate floated on top of the liquid metal was the most successful method. However, the plate alone would not retain the metal in a violent carbon boil. The plate would also be boiled out along with the metal if no other precautions were taken. Powder and aggregate tend to carry over as inclusions in the casting.

A schematic diagram of the physical reaction is illustrated in fig. 1. If the carbon monoxide bubbles form faster than they escape, the metal runs over the top of the crucible. This has been experienced with 3 in. of metal in a 5-in. deep crucible. Usually, however, the bubbles rise to the surface before the total volume of the bubbles plus the volume of the metal equals the volume of the crucible. When the large bubbles break through the surface, metal drops and particles are expelled from the crucible.

The carbon boil tends to be a spontaneous reaction and the control of pressure and temperature is not precise enough to control the carbon monoxide formation consistently.

Probably the most practical way to alleviate the difficulty would be to design a cover or trap that would allow evolution of the gas, but collect and remelt the metal. A large metal surface to depth ratio would allow the gases to be expelled at a minimum volume per bubble, but this would involve other heating coil and crucible problems.

Carbon could be slowly added to the metal surface in the form of very fine powder and the reaction would thereby be confined to the surface, provided reasonable stirring of the metal was realized. Actual experiments have not been conducted with the different shaped crucibles or with finely-powdered carbon. Control by controlling pressure and temperature has been employed on several dozen heats.

Degassing With Hydrogen

When hydrogen is bubbled through molten metal under a low pressure (5000 to 7000 microns) by the use of the apparatus illustrated in fig. 2, the oxygen-hydrogen reaction under the surface of the melt causes bubbling similar to the carbon boil. The degree of bubbling, however, can be controlled to some extent by controlling the flow of hydrogen.

The apparatus illustrated in fig. 2 was used in experiments where the hydrogen bathed the surface of the melt. The reaction was confined to the surface of the melt and a new surface was constantly exposed by the agitation of the melt from the induction field, as illustrated in fig. 3c. Since the gas is formed on the surface, no bubbling takes place. This practice was satisfactorily used for several hundred heats. During the hydrogen treatment the vacuum chamber is well purged, and the gases existing in the system toward the latter part of the treatment, probably consist primarily of hydrogen and water vapor, see fig. 3b.

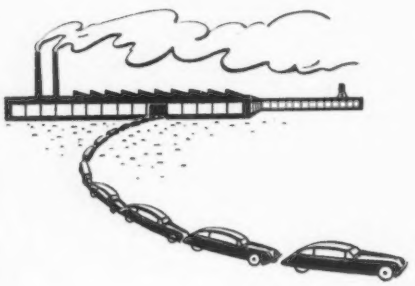
Assuming that fairly complete deoxidation has been accomplished, some hydrogen must be dissolved in the molten metal. Water vapor in the atmosphere above the melt reacts with the metal and some hydrogen is used, again reducing the oxides formed. The amount of oxides, or oxygen,

(CONTINUED ON PAGE 122)

Assembly Line . . .

WALTER G. PATTON

• Some sources see bloom falling off new car market . . . Ford adopts a new process for manufacturing 1949 radiators . . . Pontiac making extensive use of cyaniding.



DETROIT — The most significant development in the automobile industry in recent weeks is a growing lack of confidence in the future market for automobiles. No one expects the industry to curtail its output drastically overnight but there is increasing skepticism in many quarters of the ability of the industry to market its cars at present prices.

Much skepticism stems from the belief that car prices are already too high and are pushing many buyers out of the market. It is argued, therefore, that with the backwash from a third round of wage increases piled on top of present prices, the market for new cars will become even thinner.

These contentions are not altogether lacking in supporting evidence. Used car prices in many areas particularly in the middle and high priced groups, are sagging noticeably. In Detroit last week an auto dealer is reported to have offered immediate delivery of a Chrysler New Yorker. As early as last fall, there were reports that orders for cars in the highest price class were slowing up somewhat although Cadillac, it is claimed, continues to be very much in demand.

Some of the recent bloom is off the machine tool market here although volume has been highly satisfactory for most suppliers. Tool and die shops are presently filled with work. Booked volume beyond June, it is reported, is comparatively light. If it should happen that a slump in car production is pyramided on top of a saturated tooling market Detroit's tool and die segment may have to live on skimmed milk for a while rather than the fat diet the industry has been enjoying in recent months.

On the other hand, there are no positive indications that pressure on automotive steel suppliers is lessening. A survey this week, for example, indicates that auto makers are as insistent as ever about steel and some local buyers have expressed open disappointment over their inability to get their suppliers to make firm commitments for the third quarter.

While the "super" gray market may be fading there are few present indications that auto builders will be any less dependent than at present on conversion steel, particularly if they can obtain slabs which are the preferred form for rerolling.

It should be noted, however, that the premium being paid by large auto producers, while reflecting the high cost of electric furnace production plus mill conversion charges and huge transportation costs, is still far below the $300 upper limit for "super" gray market steel. For the most part, that portion of automakers' steel obtained by conversion is being bought in the $160 to $180 range—some may cost even less than this. At the moment the demand for conversion steel is still firm—but the future late this year is admittedly uncertain.

WHEREAS a month ago one would have had a difficult time finding a steel buyer who would have predicted a break in the demand for steel before the summer is over, prophets willing to be counted in this class can now be found without much searching.

No one can tell whether this change in sentiment is the result of an easier market for cars or a forlorn feeling that within a few months this country will be up to its ears in war preparations. The fact remains however, that Detroit's confidence in the future has been shaken noticeably in recent months. The second break in commodity prices will undoubtedly be interpreted in many quarters here as further evidence of a "slump in the offing."

Auto sales executives, however, remain optimistic as always. They are sure that all is not lost even if many orders for new cars turn out to be pure fiction. They argue that the industry has moved 5 million cars in periods when cars were being "sold" rather than "bought" as at present. Faith in their ability to rehabilitate their sales departments remains unshaken. And as many observers now see it, they are going to get a good chance very soon to demonstrate their sales muscles.

Other straws in the wind, probably unimportant in themselves, add to the present confused picture. These include the recent warning of NADA to auto dealers to watch credit control and to recheck their customers' credit, and the noticeable drying up of the market for American cars in foreign countries.

* * *

FORD is now using a completely mechanized process for the manufacture of radiators for its 1949 models. Practically all subassemblies have been adapted to modern materials handling methods, eliminating manual handling to a large extent.

Exemplifying Ford's present press methods is the manufacture of radiator inlets and outlets. Formerly, manufacture of these parts required five separate press operations. Three annealing cycles had to be alternated between the drawing operations.

The new process calls for completion of the part from disc blank to finished part in a single 10-station progressive die press. After passing through drawing, piercing, forming and beading, finished parts

are deposited automatically on a conveyer which carries them through a gas-fired annealing furnace.

Ford is placing great emphasis on straight line flow of parts to subassemblies, final assemblies, testing, inspection, painting and shipping.

Radiator cores, formerly individually fluxed, are now being handled in a rotary fluxing fixture.

Utilizing a conveyerized, gas-fired soldering oven, the top and bottom ends of radiator tubes are being soldered to the headers by an automatic process which has entirely eliminated mannual handling and manual bench operations.

Following the soldering operation, 15 different assembly operations are now accomplished while the work is traveling on a merry-go-round type assembly conveyer. This work was formerly accomplished manually on benches.

A final assembly conveyer reduces physical effort on the part of workers and largely eliminates damage to fins which formerly resulted when bench operation was being used.

* * *

TWENTY new heat treating furnaces have been installed in the Pontiac heat treat plant and older equipment has been completely rebuilt. A total of 80 different Pontiac car parts are being heat treated in the new department.

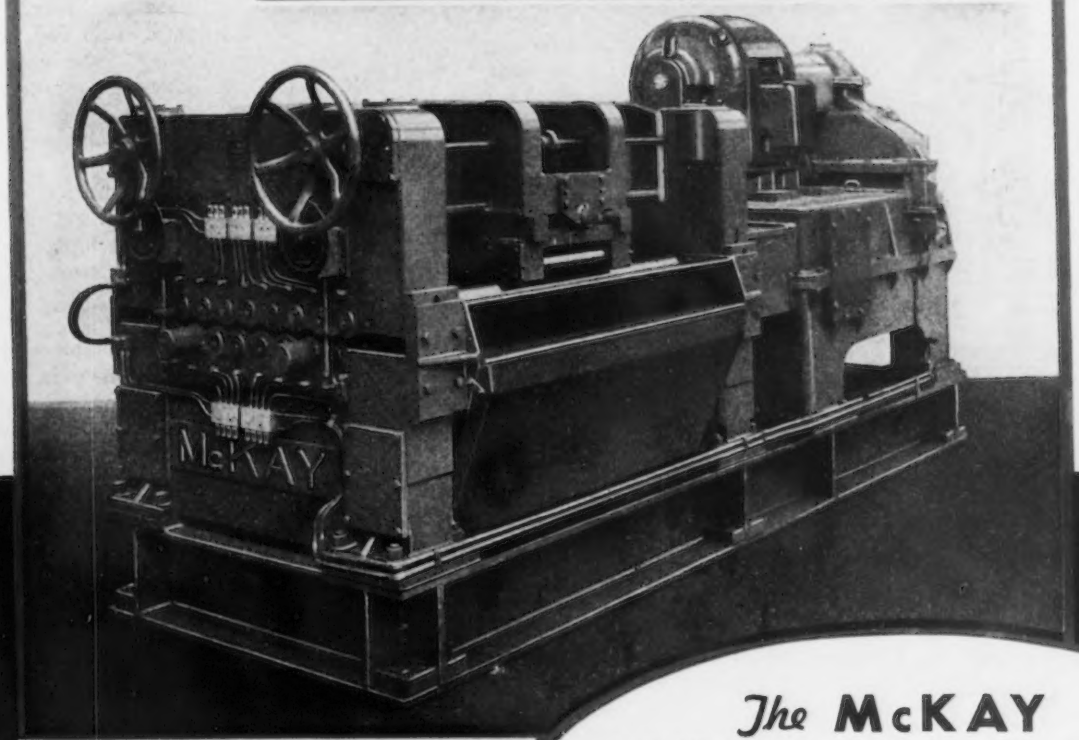
Gas carburizing is used for principal case-hardening operations. Case depth is regulated according to the part. Certain Hydra-Matic parts, for example, require only a thin case, while camshafts are given a much heavier case to resist wear.

The camshafts are first carburized after which the gears are cut and the bearings are rough ground. The parts are then placed in a hardening furnace for 1 hr at 1525°F. A rotating horizontal quenching fixture is used for a caustic quench. After quenching, the cams are reheated at 350°F for 1½ to 2 hr, after which they are sent to the machine shop for the final grind on all wearing surfaces.

At the present time 60 different Pontiac parts are cyanide hardened; about 20 other parts are hardened by other methods. The hardening furnace, quench tank and tempering unit for steering knuckles is entirely automatic.

McKAY

BACKED-UP ROLLER LEVELERS



FEATURES

Compact design reduces required floor space.

All adjustments are readily accessible to the operator.

Accurate indicating dials are provided for the screwdowns.

Alloy steel Helical gears are used throughout—fully enclosed and running in oil.

Drive is through Universal couplings.

One-shot lubrication system.

Rugged construction insures continuous performance and low maintenance cost.

The McKAY

Backed-Up Roller Leveling Machine has extraordinary rigidity because its small diameter work rolls are supported by backing-up rolls. This type of leveling works the sheet more thoroughly.

Sheets processed on this type of leveler are strain relieved to a greater extent and have far superior stamping and drawing qualities than those processed by the ordinary leveler.

The McKAY MACHINE Company

ENGINEERS AND MANUFACTURERS OF SHEET, TIN, AND STRIP MILL EQUIPMENT

YOUNGSTOWN, OHIO

ASSOCIATED COMPANY The WEAN ENGINEERING CO., Inc. • WARREN, OHIO

PERFORMANCE
RUGGEDNESS
PRECISION AND
SAFETY

Washington . . .

EUGENE J. HARDY

• German mission reports 10,000,000 tons of scrap available . . . Recommends strong measures to return scrap to U. S. . . . Immediate action not likely.

WASHINGTON — Vigorous governmental measures to obtain a portion of the estimated 10,000,000 tons of German surplus iron and steel scrap for the American steel industry can be expected as a result of the report of the recently returned industry-government scrap mission.

While the mission's recommendations, if adopted, will result in a large flow of scrap from Germany to the U. S., it is not expected that anything concrete will be accomplished for another 3 to 4 months. Industry members, particularly those from the scrap trade, were enthusiastic about getting scrap out of Germany.

As previously reported in THE IRON AGE, the mission, in its 2-month tour of Bizonal Germany, found that Army-generated scrap has about run out. Its report states that no significant quantity of this scrap beyond that already committed under contract is expected to be available. Included in the Army scrap already sold is 60,000 tons which went to Belgium and the Canterbury Corp's. 147,000 tons now being returned to the United States. As a point of comparison the report emphasizes that the British have taken more than 50,000 tons of scrap out of Germany since the end of the war.

CHAIRMAN of the Mission, John L. Haynes, Dept. of Commorce, points out, however, that even with German steel production of 4,000,000 tons this year scrap requirements can be met largely from normal sources of supply and excessive inventories at the mills and scrap yards. He estimates that scrap yards in Bizonal Germany now hold more than 200,000 tons of scrap.

Therefore, the mission reports, all Army-generated scrap, captured enemy equipment, and rubble of all kinds "is potentially available for export," without interfering with the German steel industry.

Of the 10,000,000 ton potential, it is estimated that two-thirds consists of railway, bridge, and damaged plants—all readily accessible. The remainder is composed of residential, commercial, and public buildings—which presents a bigger problem.

The mission's major recommendation calls for the estiblashment of an Anglo-American corporation, or American corporation with a British counterpart, as the central scrap purchasing agency for the Bizonal area. This corporation would have broad powers, including the authority to take over unsatisfactory operators in the German scrap industry. Its efforts would be coordinated with those of a special Military Government scrap office, also recommended in the report. Mr. Haynes states that General Clay, U. S. Military Governor of Germany, indicated that he would be agreeable to having an American corporation come in to do the job.

ONE OF the more interesting recommendations calls for United States adoption of a broader definition of captured enemy material. While the United States includes only actual munitions and implements of war in its definition, the British also include other items, such as semi-finished steel intended for munitions use.

In addition, the United States has turned such materials back to the Germans for their own use. However, the Germans have not used this material as had been expected and there are more than 100,000 tons in dumps and 40,000 tons that has not been collected. The British have taken possession of material of this type in their zone and returned some of it to England.

As a result, the mission recommends that the U. S. regain title to this material and adopt a definition similar to that used by the British.

WHILE not recommended by the mission, there is strong sentiment in Washington, particularly on Capitol Hill, for a policy which would permit the Army to requisition any of this material, including rubble. The State Dept. is expected to vigorously oppose such a move.

Two of the major difficulties in obtaining rubble scrap are: (1) The difficulty in identifying the owner, and (2) inducing him to part with it. Owners as well as scrap dealers are reluctant to sell for export, due to the fact that they are not permitted to hold hard currency and are paid at frozen 1936 prices, $7 to $8 a ton according to Mr. Haynes, in reichsmarks, which are practically worthless. Some of this reluctance is also ascribed to nationalistic reasons, since the Germans consider scrap as a valuable war potential.

EQUIPMENT and manpower are also short. The latter problem is largely one of inadequate food. Scrap workers are not classed as priority personnel that are fed one hot meal a day.

Accordingly, the mission recommended the institution of a broad system of incentives, including special rations; establishment of a program whereby some hard currency may accrue to scrap owners and dealers, and an upward adjustment in the reichsmark price.

Faster Cutting, Longer Tool-Life, Reported for the New Sun Cutting Fluids Containing No Animal or Vegetable Fatty Oils

Since Sun recently announced the new grades of Sunicut with Petrofac, favorable performance reports have been coming in on practically every kind of metal-cutting job.

Higher cutting speeds, longer tool-life, increased production, better finish, performance superior to that of any cutting oils previously used . . . these are the "Job Proved" results that are constantly being reported.

"10% increase in tool-life on our automatics" . . . "chaser-life increased 50% on pipe-threading machines" . . . "finer finishes" . . . "best cutting oil I have ever used" . . . say typical reports from our customers.

No animal or vegetable fatty oils go into the new Sunicut grades. The Petrofac used in compounding is entirely derived from petroleum. The new Sunicut Cutting Oils with Petrofac possess superior metal-wetting and anti-welding properties, as well as unusual extreme-pressure characteristics.

Sunicut with Petrofac will not turn rancid. It is available in plentiful supplies and at reasonable, stable prices. Call in your Sun Cutting Oil Engineer for full information, or write Department IA-3.

SUN OIL COMPANY
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*Petrofac is a trade-mark of Sun Oil Company

Steel Exports Jump 2 Million Tons In 1947 Despite Fight

Washington

• • • **Despite efforts** of steel consumers to force curtailment of iron and steel exports last year, the latest Commerce Dept. figures show that 1947 iron and steel exports totaled 6,591,282 net tons—nearly two million tons more than in 1946. It is estimated that 4,200,000 tons of this amount were shipped directly by steel companies.

Shipments thus far this year have dipped slightly, but both the government and industry point out that this condition will change rapidly when the European Recovery Program gets under way.

The upward trend becomes more evident when the 1947 total is compared with 1946 total exports of 4,750,775 tons. In 1945 the total was 4,841,461 tons.

Iron and steel exports compiled by the Commerce Dept. total as follows: for 1947 Semifinished including ingots, blooms, billets, slabs, sheet bars, 490,765 tons; other steel bars (excluding alloy) 535,421 tons; plates, not fabricated 530,265 tons; black sheets 568,867 tons; tinplate 609,509 tons; structural shapes 754,182 tons; rail 500,584 tons; seamless casing and oil line pipe 333,498 tons.

Exports of iron and steel in 1946 included the following: Ingots, blooms, billets, slabs, sheet bars, 452,533 tons; other steel bars excluding alloy), 339,905; plates, not fabricated, 470,263; steel sheets, black, 482,785; tinplate, 377,946; structural shapes, 418,579; rails, 385,583; seamless casing and oil line pipe, 179,783.

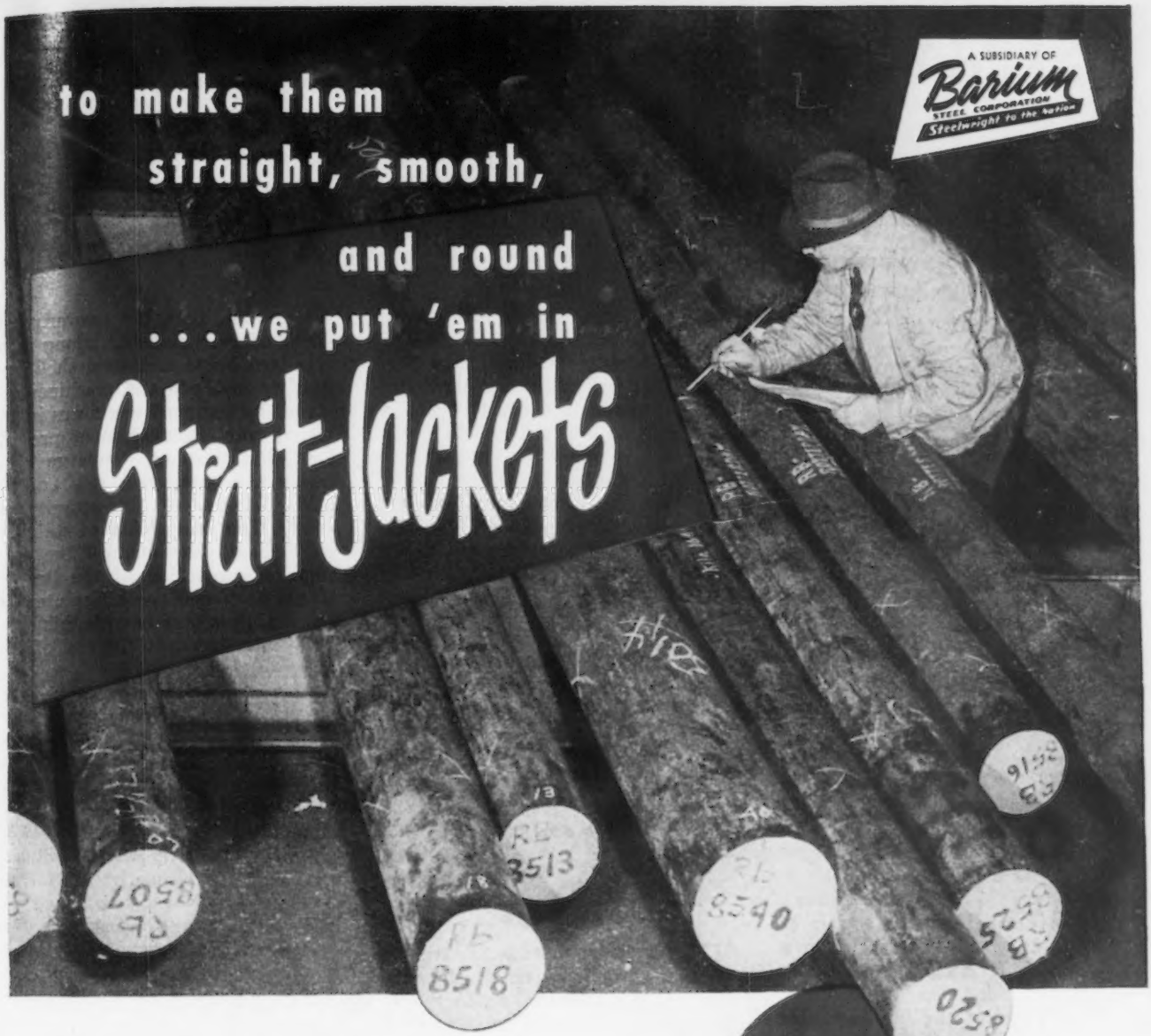
In 1945, iron and steel exports included the following: Ingots, blooms, billets, slabs, sheet bars, 203,745 tons; other steel bars (excluding alloy), 214,903; plates, not fabricated, 188,478; steel sheets, black, 742,423; tinplate, 470,638; structural shapes, 343,790; rails, 327,994; seamless casing and oil line pipe, 256,770.

WAA On Doomed List

Washington

• • • **In a special** message, the White House has asked Congress to let WAA die as of June 30 and transfer its functions to the Federal Works Agency.

THE BULL OF THE WOODS — BY J. R. WILLIAMS



The above picture of Barium forged rounds is un-retouched. Contour dies insure a smooth, round product.

There is a difference in forged rounds. We forge our round bars in swage or contour dies which produce a smooth, straight, and round finished bar that is true to size. These are worked down from ingots or billets of sufficiently large sections to insure sound centers. Manufacturers who formerly purchased rough turned rounds are now buying our smooth forged product and enjoying large savings.

We invite your inquiries. Remember! . . . if it's a *forging* you can buy it from Barium.

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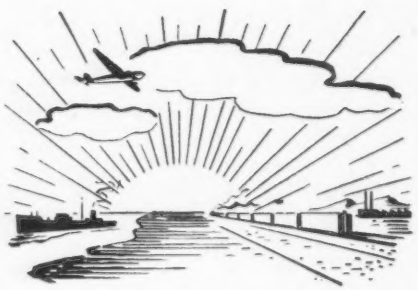
West Coast . . .

ROBERT T. REINHARDT

• Kaiser proves he is good risk to Reconstruction Finance Corp. . . . Builders hope for more pipe . . . Alcoa selling more aluminum pipe.



LOS ANGELES — Once more Henry J. Kaiser is being called a "smart politician, clever business man or miracle man" by western industrialists as the result of the Reconstruction Finance Corp. loaning another $3 million to Kaiser Co. Inc., Iron & Steel Div. It all depends on to whom you talk.

This is one of the few instances on record where the government has shelled out further capital to one of its debtors who has been using every legal means to have its existing debt reduced. Apparently the RFC is deaf to pleas for a debt reduction based on the fact that costs of building the steel plant at Fontana, Calif. during the war were excessive, but this loan agency is willing to throw a few additional millions in the pot to protect its investment.

Kaiser Co., Inc. has been a good credit risk up to now and has fulfilled all of its obligations while attempting to have them reduced and the company has some sound arguments to present in favor of increasing facilities to protect those now at work. The $3 million acquired last week from RFC is earmarked for construction of at least one additional openhearth furnace —probably of 185 tons capacity as are the other six—and will provide additional ingot capacity to bring it into balance with finishing facilities.

Pipe hungry builders in the West hope that this additional ingot supply will mean that the Fretz-Moon pipe mill at Fontana will be working on a three-shift instead of a two-shift basis before the end of this year. With an annual capacity of approximately 120,000 to 140,000 tons of pipe in sizes of from ½ in. to 4 in., this mill, which only recently came into production first had to loaf along on a one-shift basis and is now being held back from full production because of a shortage of skelp which could be rolled if the steel were available.

When the seventh openhearth, soaking pits and incidental facilities are completed, total annual ingot capacity of the plant will be approximately 820,000 tons. The 10-ton electric furnace, which was operated only briefly after completion, is still down.

THE pipe business is apparently an attractive one at the moment. It is known that another pipe mill for this area is in the offing sponsored by an independent operator which would have to purchase its skelp on the open market. There are still too many "ifs, ands, and buts" to be settled on this project before complete details will be revealed. There seems but little question that the market on the Coast for pipe is well in excess of supply, but the availability of skelp is another thing.

Aluminum Co. of America is finding a ready market for its aluminum pipe in steel pipe sizes even though the cost per pound is considerably above that for steel. The local Alcoa plant is extruding thousands of feet of this material each month along with light wall material used in portable overhead irrigation system and similar applications.

Aluminum is an important material in the plant of the Norris tamping & Equipment Co. here which is producing a heavy volume of shell canisters and powder bag containers for the government made of this material, along with standard brass and steel shell casings by methods and machines designed by company engineers in the recent war. Production of pressed steel bathtubs on twolarge contracts has been on a stop and go basis because of the scareity of sheets. The availability of stainless steel sheets has enabled the continuous production of the line of copper-bottomed cooking utensils and stainless beer barrels this company introduced at the end of the war.

Norris is entering a new venture which begins operation in April for the production of liquid gas cylinders. Norris Stamping will make the rounded ends for the cylinders which will be fabricated by a new company headed by D. J. Will, president, formerly with the Stuart Oxygen Co. Kenneth T. Norris, president of Norris Stamping, is vice-president and treasurer. The new plant will have a capacity of 1000 cylinders per day according to Mr. Norris.

* * *

WHILE there are some polite efforts to conceal it, local industry is a bit smug about the fact that the city of Los Angeles is now sending 135,000 kw of electricity to the northern part of the state to help alleviate the serious shortage there brought about by unprecedented drought. Principal benefit to the northern part of the state will be in enabling farmers in the San Joaquin Valley to continue pumping the precious underground water for the irrigation of their crops. Such pumping had been limited because hydro-electric plants in the north were producting power at low levels and it was necessary to spread the kilowatts as far as possible.

Industry in the San Francisco Bay area has been affected to the extent that five or six major establishments have had to either shut down completely because they were on a "surplus" basis, or have had

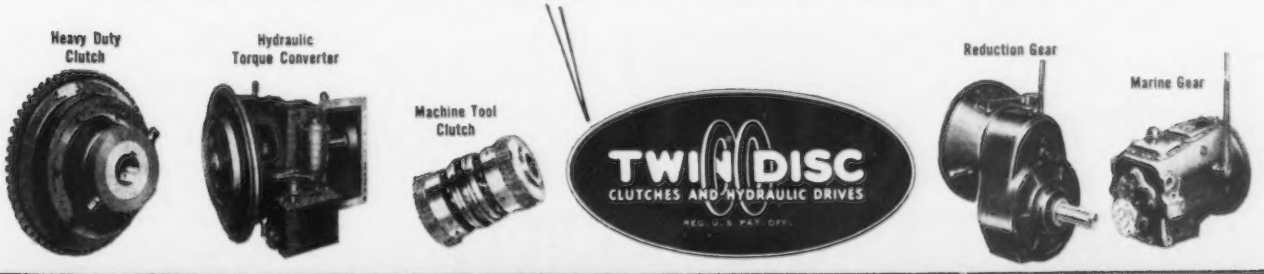
Focus on Perfection...

Lights at the correct angle... the model in position ... the camera set. The photographer is ready for that split-second flick of the shutter which captures the lasting image.

This machine-age artist keeps his sights on *perfection* ... strives to achieve it by applying new techniques to the firm foundation of experience.

In the field of power transmission as well as in photography, the focus is on perfection. Engineers of the Twin Disc Clutch Company strive for perfection in much the same manner as the skilled photographer. They apply the most modern techniques of design to the newest theories of hydraulic or mechanical power transmission, in achieving the complete Twin Disc line of clutches and hydraulic drives.

If you have a problem in power transmission, ask the assistance of Twin Disc engineers. Their recommendations will be based on 30 years of experience in the field. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

to reduce production. Part of the power being shunted north is produced at Hoover Dam.

* * *

While Columbia Steel Co. officials are reticent on the subject, there are many industrialists wondering why the Dept. of Justice is taking so long to decide whether the company can legally purchase the abandoned aluminum plant at Torrance on which its bid was accepted last January. At that time Columbia announced it was to build its cold-rolling mill on the site which it had purchased for $4.2 million. A down payment of $½ million was made on Feb. 1 as stipulated in the WAA agreement and up to last week the Dept. of Justice had not announced its approval. It is known that Columbia, through its parent company, U. S. Steel Corp., has already placed its order with Mesta at Pittsburgh for one of the cold-rolling mills to be used in the plant.

Local steel-hungry manufacturers see no excuse for the delay in action by Tom Clark, unless it is because he is awaiting decision of the Supreme Court on whether Columbia may legally purchase Consolidated Steel Corp. Even then the connection is considered "irrelevant and immaterial" by most critics who are more interested in production than they are in politics.

Koppers Raises Benefits On Its Group Insurance

Pittsburgh

• • • **Koppers Co., Inc.,** reports liberalization of its group insurance program, increasing benefits available to hourly-paid workers and cutting unit cost for them and salaried employees alike. The company will pay increased costs under the new plan if 75 pct of hourly and piece work employees sign up, H. H. Hook, the company's insurance section manager said.

Group life insurance for hourly and piece rate workers, formerly limited to $1500, can now be stepped up to $3500, Mr. Hook said, and at a lower cost per thousand. These employees may also receive more liberal sickness and accident benefits. Koppers, with 14,000 employees at 53 plant locations, has had group insurance for 13 years.

CMP stainless
THINSTEEL
TRADE MARK

This important message means improved or new stainless products at lower fabricating costs.

It's another FIRST for CMP — light gauge 18-8 and other chrome-nickel grades of stainless strip steel with a bright rolled mirror-like finish even in dead soft annealed temper. Stainless fabricators familiar with the lustrous rolled finish generally identified in annealed stainless only with chromium grades such as Type 430 will immediately recognize the possibilities of new applications, increased utility and beauty, together with lowered finishing costs which this interesting development in chrome-nickel stainless now suggests. We will be glad to send you a sample of this new product and will welcome the opportunity to explore any application where a combination of corrosion resistance and beauty of appearance in light gauge metal strip is desirable.

COLD FACTS ON
THINSTEEL

- **EXTRA LONG COILS**
  ... less downtime
- **EXTREMELY CLOSE TOLERANCES**
  ... more parts per ton
- **WIDE RANGE OF PHYSICALS AND ANALYSES**
  ... tailored for your products
- **GAUGES THIN AS .001"**
  ... strength with lightness

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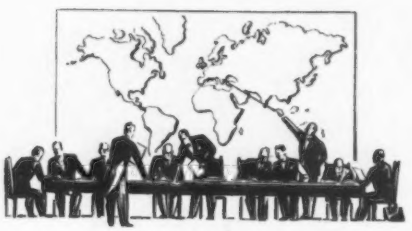
European Letter . . .

• History again repeats itself with small countries engulfed by tyranny of powerful neighbor . . . Russia's recent coup makes all aware of real meaning of Communist shadow organiaztions.



CZECHOSLOVAKIA and Finland—the two countries upon which the Soviet vice is closing—are more than two small countries engulfed by the tyranny of a powerful neighbor. They are symbols and portents in the mind of Europe—symbols of a former betrayal by the west, portents of war and desruction which might be in store.

The wave of grief and alarm that has swept over the free world draws some, at least, of its strength and bitterness from memories of 1939. So much bloodshed, so much sacrifice, so much suffering have been spent and borne to undo the injustices of that year. Now, barely a decade later, Europe is apparently back at that melancholy starting point.

Yet the western nations should not resort to mere foreboding in measuring the significance of the Communists' latest moves. What has happened in Prague resembles only in part the aggression of the Nazis 9 years ago. Both acts of violation involved the destruction of free government by an internal minority allied to an outside Power, but the motives are not the same. Paradoxical though it may seem, Russia's action in Czechoslovakia is in one important respect a defensive act—a consolidation of a control already in being in order to ward off imagined dangers from without.

In truth, neither in Czechoslovakia nor in Finland could the Communists be certain of maintaining their position at the forthcoming elections in May and July. On the contrary, all the evidence suggested that they were likely to lose ground quite heavily. This setback would have occurred at a time when political confidence and economic recovery in the west are likely to be strengthened by the first stage of the Marshall Plan.

INDEED, the fall in Communist popularity may already have been partly caused by new hope of better times among the free peoples of the west. The Russians have been on the defensive ever since the chance of a recovery program appeared on Europe's horizon, when the Cominform was hastily brought into being as the General Staff of the ideological war against the Marshall Plan.

Czechoslovakia, the most democratic member in form and spirit of the east European bloc, whose government first accepted the invitation to participate in the Paris Conference and then, on Russian insructions, withdrew, was the most exposed salient in the anti-Marshall line. The recent coup hammered out the salient and closed the chief door by which pernicious influences from the west might have entered.

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The policy practiced at Prague, in its brutality, its open duplicity, clumsy fakes, disguises, and contradictions, bears, in spite of its careful secret preparation, many of the marks of an action dictated by fear. And, like most actions dictated by fear, some of its results will not accord with what its perpetrators intended. If Russia's aim in screwing down the nails in the Czechs' coffin was to lessen the chances of the Marshall Plan and to win a round in the struggle against European recovery, the coup at Prague has failed. The Communists have, vastly increased the chances that the Marshall Plan may succeed outside their sphere.

The reaction has been general and immediate. In Washington, Senator Vandenberg, in the masterly fashion he has made his own, has been able to present his Bill for European Recovery to the Senate in an atmosphere which makes isolationism seem lunacy and support for Mr. Wallace almost treason.

IN WESTERN Europe at large, the urgency of uniting the Sixteen Nations in a single bloc has gained fresh point. Inside each nation, all parties have received a last warning that no spoon is long enough for those who sup with the Communists. This realization may, perhaps, even offer some hope that, in France, the bickerings between the non-Communist groups may cease, General de Gaulle may decide to join forces with the constitutional parties and the strength and influence of M. Leon Jouhaux and his *Force Ouvriere* may receive a new impetus.

In Italy, the defection of Left-wing Nenni Socialists to the constitutional Saragat wing is reported to be considerable. All save the Communists and their fellow-travellers are now alive to the real meaing of the great variety of Communist "shadow organizations" which exist in every field and ominously recall Czechoslovakia's "action committees." Prudent Russian policy would have wooed America and Europe into a false sense of security. Instead, every red light, every burglar alarm, every whistle has been set blinking and blaring from one end of the Continent to the other.

To recognize the Communist danger for what it is, and to realize that the latest moves are primarily defensive is not, however, to say that there is no real threat to western Europe and that nothing needs to be done. The ruthlessness of the Czech coup is a measure not only of the Communists' fear, but also of their determination.

PERSONALS

ROBERT K. FOLLANSBEE, secretary-treasurer, Follansbee Steel Corp.

• **Robert K. Follansbee** has been elected secretary-treasurer of the Follansbee Steel Corp., Pittsburgh, and succeeds the late **Edgar Masters.** Mr. Fallansbee has been associated with the Follansbee Steel Corp. or its affiliates since 1928.

• **Gerald F. Lange** has been named sales manager of the metal combination window division of the Barnard Co. of Buffalo.

• **F. H. Johnson** has been appointed an assistant chief engineer of Carnegie-Illinois Steel Corp., Pittsburgh. He came to Carnegie-Illinois in 1940 as an engineer at South Works in Chicago. He was made defense engineer in Pittsburgh in 1941, and was chief engineer for the Chicago district of the company at the time of his present appointment.

• **Louis Allis, Jr.** has been elected vice-president in charge of sales, Louis Allis Co., Milwaukee. **Frank O. Kovich** has been elected vice-president in charge of manufacturing, and **T. R. Wieseman,** vice-president in charge of engineering. **C. G. Skidmore** has been appointed sales manager of Louis Allis; **James H. Daganhardt,** chief engineer; and **John J. Kirkish** has been made chief of electrical design.

• **Nils Lou,** formerly factory manager of the Glenn L. Martin Co. of Baltimore, has been appointed tractor plant manager of Harry Ferguson, Inc., Detroit.

• **Howard C. Williams,** since 1940 sales manager of the merchant trade division of Continental Steel Corp., Kokomo, Ind., has been named sales manager of the sheet division of the company.

• **Lewis Gordon** has been appointed director of the international sales division of Sylvania Electric Products Inc., New York. He replaces **Walter A. Coogan,** who has resigned. Previously Mr. Gordon was assistant to the vice-president in charge of sales.

• **Bernard Lester,** assistant manager, industrial sales department, Westinghouse Electric Corp., Pittsburgh, has retired after 43 years of service.

• **James P. Tate** has been appointed Brazilian sales agent and service engineer for Herman Pneumatic Machine Co. of Pittsburgh. Mr. Tate will set up an office in San Paulo.

• **R. G. Rydin** has been appointed assistant vice-president, executive department, Santa Fe Ry., Chicago. **Leo E. Sievert,** general attorney for the line in California, has been named to succeed Mr. Rydin as executive representative of the president.

• **George E. Burley** has been made director of purchases of the Lustron Corp., Columbus, Ohio. Mr. Burley, who has been with the Budd Co. in Detroit since 1928, has resigned as assistant director of purchases for that firm to take up his new duties.

• **Edwin W. Kaler** has been appointed vice-president for sales of the Daystrom Corp., Olean and Friendship, N. Y. Mr. Kaler comes to Daystrom from Archer Mills, Inc., Columbus, Ga., where he was vice-president for sales.

• **Peter T. Badame** has been appointed general sales manager of the National Plating Co. of Buffalo. He formerly was a chemist for the Du Pont company.

• **W. J. Meyer** has joined the sales staff of Luria Eng. Corp., New York. He was formerly in the New York sales office of Pittsburgh Steel Co.

JAMES L. BYROM, manager, Chandler-Evans Div., Niles-Bement-Pond Co.

• **James L. Byrom** has been appointed manager of the Chandler-Evans Div. of Niles-Bement-Pond Co., West Hartford, Conn. He succeeds **Leslie McArthur,** who has been appointed a vice-president. Mr. Byrom joined the Chandler-Evans Div. as a production and engineering executive in 1947.

• **H. F. Hazel** has been named superintendent of the Southwest Steel Rolling Mills, Los Angeles.

• **A. R. Stevenson,** formerly midwest sales manager for Tube Turns Co., Louisville, is now representing Mid-West Forge Co. of Cleveland. Mr. Stevenson will service the Detroit area for Mid-West Forge.

• **Charles W. Young** has been appointed plant manager of the Pennsylvania Flexible Metallic Tubing Co., Philadelphia. He has been employed by the company for over 20 years and has participated in the supervision of various departments throughout the plant.

• **A. D. Vining** has been made general sales manager at White Products Co., Middleville, Mich.

• **John J. Laughlin** has returned to TelAutograph Corp. in the capacity of branch manager of the Boston office. For the past 5 years Mr. Laughlin represented Holtzer-Cabot Div. of First Industrial Corp. Prior to that he spent 17 years with TelAutograph in various service and sales posts.

Industrial News Summary...

- **Coal Strike Would Hurt Steel**
- **Regular Demand is Still Heavy**
- **Gray Market Decline Continues**

THE only fly in the ointment to prevent sustained peak output of steel over the next several months is the current coal mine stoppage. Any long shutdown in the mines will cripple the steel industry within 10 days to 2 weeks after coal shipments stop. Stocks are not low but the high operating rate is using up coke at a record pace.

But if there is no interruption the output of steel this year will top any other year in the industry's history. It is probable that without labor trouble more than 90 million tons of steel could be made. This would be more than the peak war year, when 89.5 million tons were produced.

Even with the unusual speed in turning out steel, the industry this week is making little headway in reducing its backlogs. A survey taken by IRON AGE district editors failed to show any weak points in regular steel demand. Customers were still pushing for deliveries on most items. The crackup in the top gray steel market has had no effect on regular steel demand or order volume.

Last week's decline in demand for gray market steel was still sharply visible this week. More and more users were unwilling to pay peak prices—compared to a few months ago when no questions were asked. It is true that steel is still being sold at prices in excess of the mill price but the average prices for such material are somewhat below the fantastic prices of recent weeks when $333 a ton was paid for cold rolled sheets.

As to conversion deals—those that are so-called legitimate projects show no change of any magnitude —but in cases where the steel users have to pay high prices for ingots or semi-finished steel and then pay high conversion charges, there has been a marked attitude of aloofness on the part of consumers. This trend will continue as steel users scan the ultimate market for their own products.

DESPITE all the talk about the possibility of a drop in steel orders because of the general note of caution, there is no evidence this week that steel will suffer any setback either in the immediate future or over the next many months.

There are many large steel users who would send up a prayer if other steel consumers would drop off in their order volume. That would be a chance to get the steel that they have been yelling for over the past few years. First among large users who would like more steel are the gas and oil people.

Steel requirements for oil and gas lines, as well as other pipe used in these industries, is larger than ever before in history. Some oil officials say that if the economy of the country is not to suffer next winter, oil and gas lines must be built—and quickly. More emphasis is put on the need for gas lines to alleviate the heavy demand on crude oil. At any rate the oil and gas industry can use more than 6 million tons of steel as soon as they can get it to complete pipe lines that have been approved or are active projects.

Among the major factors seen tending to keep a strong steel demand for sometime are: (1) Demand from the railroads where freight cars, passenger cars, rails, repairs and general maintenance are No. 1 problems (2) container industry requirements are still heavy and are bound to increase as general-line can uses regain their prewar percentage of the market (3) ERP demands will be heavy in view of the international unrest (4) Automobile demand may fall because of prices but at the same time realistic sales possibilities with new models and better cars are still good (5) a shaking down of construction costs will start a flow of orders for municipal, state and industrial building and (6) general demand from thousands of miscellaneous users of steel is in no way sharply falling off.

THE outburst over steel prices has effectively held at bay any rise in the price of additional steel products by the large makers. While U. S. Steel may in the future not necessarily take the lead in naming new prices, any independent steel firm would think twice before raising quotations if it thought that the major interest would not follow. Until the steel wage problem is out of the way it is extremely doubtful if there will be any major price changes in steel. If wages are advanced as expected price changes will be thought out exhaustively before any final move is made—that is for sure.

The steel scrap market can not be called soft this week. But it does look as if major buys in the next round of offers will be at lower prices. This does not mean that the market is going to fall apart. There is no chance of that. The underlying strength in the scrap market is still there—it will stay there as long as there is a chance that demand for steel will support a 90 million ton year.

There is no short cut to steel production. Increased pig iron output depends on the coke supply. That is not too good now nor is there any chance that it will be much better for several months. Dependence on scrap to make up for the increased level of steel output is still a major factor. The long term outlook for scrap is not good. But there is now no possibility that the scrap market prices will hit the unusually high levels of several months ago. The peak has been reached and the bloom is off.

Steel ingot output this week moved up half a point to 97 pct of rated capacity from last week's revised rate of 96.5. THE IRON AGE scrap price composite has remained unchanged at $39.50 a gross ton and still represents the low for the year to date.

• **BRITISH STOCKS DOWN**—The government white paper released last week disclosed that the recent period of high steel production ran stocks of pig iron, scrap, and semifinished steel down dangerously low. The government reported that there are potentially tragic shortages of pig iron, scrap, coke, and transportation threatening the industry of Britain today. It is reported that only two weeks supply of scrap are left, and that at least 850,000 tons are needed this year. The government recognizes no significant source of supply other than Germany. The nine million tons of imported ore needed this year will tax British port handling facilities to the utmost. Efforts to reduce steel exports from the United Kingdom have failed, as the bilateral bargaining for food and raw materials requires even higher commitments.

• **NO GRASS SKIRTS?**—About $22 million worth of surplus property now in Hawaii, including quantities of industrial equipment, maintenance spare parts, marine vessels, automotive equipment and parts, and various kinds of machinery, will be put up for sale during the remainder of March and in April. Most of the property will be available to all buyers on an equal basis through fixed price, sealed bids, and negotiated sales. Details may be obtained from the WAA regional office in Honolulu.

• **FRENCH STEEL PROSPECTS**—Recent agreements to increase exports of coal and coke from Germany to France have raised the hopes of the iron and steel industry in France. There is talk of a fuel allocation that would permit ingot production to go up to a monthly average of 700,000 metric tons, compared with an average of 479,000 tons per month last year. The 1929 average was 809,000 tons.

• **HEALTH HAZARDS**—Health hazards to arc welders on steel shipbuilding work are negligible when adequate ventilation is provided, according to the Public Health Service. PHS Bulletin No. 298 reports in detail the results of its wartime study during which 4650 men and women ship welders were examined. It may be obtained from the Superintendent of Documents, Washington 25, D. C., for 55¢.

• **RAILROAD SCRAP WEEK**—To bolster the supply of scrap moving back to steel companies from railroad sources, the railroads have named April 5-10 as "Railroad Scrap Collection Week". The railroads annually produce 3.5 to 4 million tons of scrap, and will try to increase this figure by this effort.

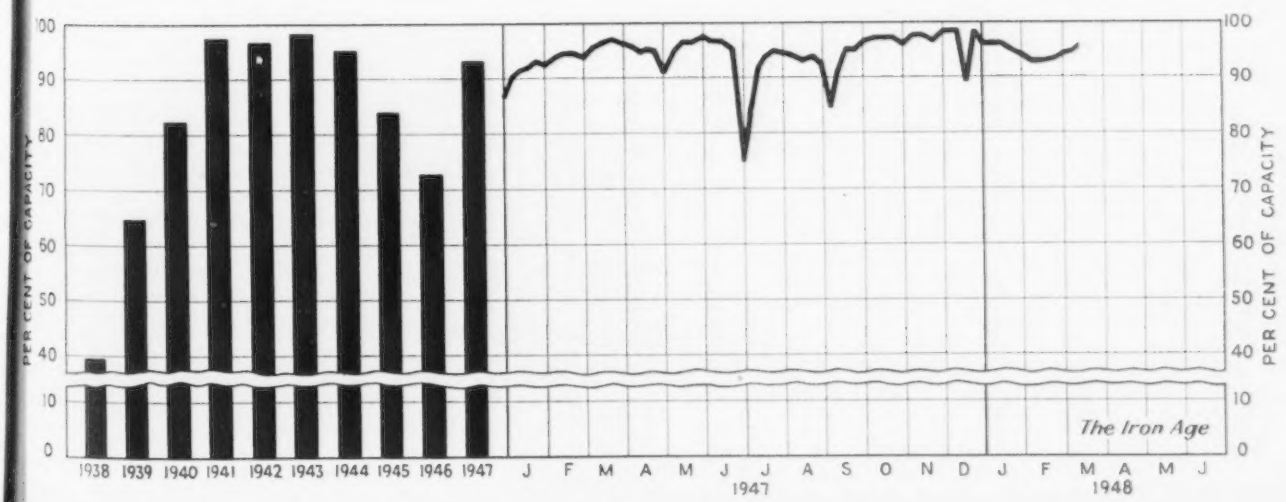
• **FACTORY WAGES** — Factory wages in January showed a decrease from the December record peak of $52.74 weekly to $52.27, according to the BLS. While the average number of weekly hours worked is exactly the same as a year ago, average hourly earnings are 13¢ higher.

• **NATIONAL PRODUCTION**—Gross national production in 1947, measured by market value of goods and services, totalled $230 billion or 13 pct above the 1946 figure of $204 billion, according to the Bureau of Domestic Commerce. National income, comprised of total earnings from national production, rose from $178 billion in 1946 to $203 billion for last year.

• **FEBRUARY RECORD**—Steel production in February set a new peacetime record for the month and topped the February 1947 output by more than half a million tons, according to the American Iron & Steel Institute. Output of ingots and steel for castings was placed at 6,940,653. The steel operating rate during February averaged 93.0 pct of capacity, as against 91.7 pct of the small capacity existing a year ago.

• **PITTSBURGH EMPLOYMENT**—Manufacturing employment in the Pittsburgh industrial area increased by 51 pct between 1939 and 1946, according to the Allegheny Conference on Community Development. It is based on questionnaires returned by 53 companies which employ about 78 pct of those in manufacturing in Allegheny, Beaver, Washington and Westmoreland counties. The detailed inventory shows a high degree of stability over the years. Over 400 companies have operated from 25 to more than 100 years. Between 1939 and 1946 as many or more new companies were established as were closed and the new companies employ more people than those discontinued.

Steel Ingot Production by Districts and Per Cent of Capacity



k of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
9	98.5	94.0	93.5*	90.0	94.0	104.0*	99.0*	102.0	101.0	104.0	104.0	77.5	106.0	96.5*
16	99.0	94.5	92.5	90.0	96.0	104.0	99.0	102.0	102.0	101.0	100.0	78.0	106.0	97.0

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Steel Exporters Squirm and Chafe as New Regulations Hit

Administrative Troubles Hurt Every Shipper in Fighting Against High Prices

By JACK HIGHT
Ass't. News-Markets Editor

New York

• • • **New export** regulations instituted Jan. 1 and Mar. 1 have independent steel exporters on the ropes. Even the export branches of steelmaking firms have been struck a staggering blow by the new rules. For the latter, the hamstringing by the Commerce Dept. is largely temporary, but for the first and second quarter, it is just as effective.

Looking at the 6.5 million tons of steel exported last year, the government decided that it was too large. Of the 6.5 million tons, it was estimated that 2 million tons were sold at prices two to four times the published mill export prices. The government decided that this practice was abhorrent. The government also noted that while the total export tonnage was impressive, very little of it was going to those European countries where it was most needed.

Looking at all these deplorable realities, and after a certain amount of Congressional goading, the Commerce Dept. belched forth a new set of export regulations covering, among other things, steel, which has effectively tied up everything.

To cut down on the total amount of steel being exported, new licensing requirements were set forth effective the first of the year. To eliminate the high priced shipments, under the anti-inflation law, the Office of International Trade of the Dept. of Commerce, which licenses the exports, started asking for a price on each shipment as of Mar. 1.

The general purpose of all this is defined by law as to "protect the domestic economy of the United States, or to carry out the foreign policy of the United States". Exactly how these purposes are to be served is largely being determined by Commerce administrators. The primary difficulty at the moment is that of setting up any new system of government controls. There are just not enough people to do the job that the government has set out to do. Not only excess and high priced exports, but all steel exports are now tied up in a vast administrative snarl that will take months to clear.

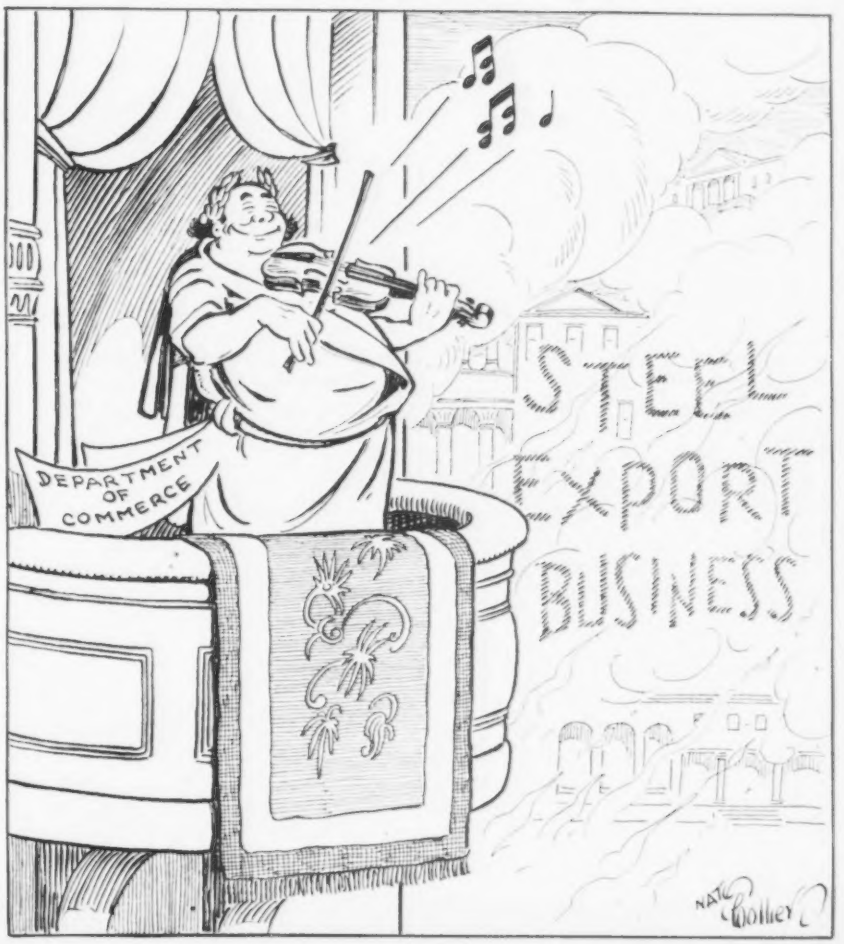
The difficulties of setting up a system of workable criteria applicable to prices, and the administrative machine necessary to handle the regulations are many. Numerous exporters are of the opinion that the job is insurmountable under present limitations. They feel that the system will break down in a few months of its own weight.

Right now, exporters who had commitments for steel from mills for the first quarter in hundreds of cases still have not received their export licenses. This is true in the cases of direct exports from steel mills, as well as those set up by export-import houses.

Normally, steel mills like to work against a 60 day lead time in their mill scheduling. Instead, they are now in the last month of the quarter, and still do not know the program. As a result, some companies which have adhered to a conservative price policy and have felt sure of ultimate approval of their licenses have gone ahead and had it rolled by mills. They are now piling up huge storage bills in warehouses in the East, while the Commerce Dept. tries to recruit enough help to get the license department rolling.

In the case of the private export companies, their most precious property is a regular allocation of ma-

Twentieth Century Fiddling



Industrial Briefs . . .

• ORDERS CAR WHEELS—West Steel Casting Co., Cleveland, has received an order from Jones & Laughlin Steel Corp. for 22,400 cast steel mine car wheels. The wheels are for use on 2800 new design mine cars to be installed in the mine consolidation program of Jones & Laughlin at Vestaburg, Washington County, Pa.

• ACQUISITION — Majority stock interest in the Farm Tools Inc., Mansfield, Ohio, has been acquired by Walter E. Schott and Harold C. Schott, two Ohio industrialists, also Harrison O. Ash, president, the Columbia Axle Co., Cleveland. This purchase involves a consideration of $2 million.

• $1 MILLION CONTRACT—Delivery on an order for more than $1 million worth of a packaged boiler unit complete with oil burner has been started by York-Shipley, Inc., York, Pa., to Levitt & Son, Inc., Manhasset, L. I., N. Y., for use in a building project of 4000 new homes.

• RYERSON EXPANDS — Joseph T. Ryerson & Son, Inc. has completed the construction of a new steel service plant in the San Francisco Bay area in Emeryville, Calif.

• NACE AWARDS—Dr. Ulick R. Evans has been honored with the Willis Rodney Whitney Award in corrosion science and Dr. John M. Pearson with the Frank Newman Speller Award in corrosion engineering by the National Assn. of Corrosion Engineers.

• NAMES DISTRIBUTOR — Standard Brass & Mfg. Co., Beaumont, Tex., has been named distributor for Parker Appliance Co., Cleveland. Standard will handle complete line of Parker tube fittings, valves and accessories for hydraulic and fluid-handling systems.

• WELDING EQUIPMENT — The Tri-Line Corp. has been formed with main offices at 170 Franklin St. Buffalo, and with branch offices at Rochester and Syracuse. The new corporation takes over the distribution and field engineering on resistance welding equipment produced by Progressive Welder Co., Detroit, and the air and hydraulic equipment formerly handled by Industrial Equipment Company.

• CAPITAL OFFICE — A Washington branch at Defense Bldg., 1026 17th St., N. W., has been opened to provide representation for Hagan Corp., Pittsburgh combustion and chemical engineering firm, and its associated companies — Hall Laboratories, Calgon, Inc., and the Buromin Co. — in the District of Columbia, Maryland, Virginia, and West Virginia.

• WEST COAST OFFICE — The Twin Disc Clutch Co., Racine, Wis., manufacturers of clutches and hydraulic drives, opened a new branch sales engineering office at 2950 Leonis Blvd., Los Angeles serving the territory including California, Arizona and Neveda.

• HEADS COMMITTEE — Lucien Eaton, consulting engineer of Milton, Mass. was named chairman of the Mining Standardization Correla Standardization Correlating Committee of the American Standards Assn., New York.

• PURCHASE—The Phosphor Bronze Corp., Philadelphia, has purchased the assets of the Phosphor Bronze Smelting Co. of the same city. Operations will continue under the same manufacturing personnel.

• MOVES — The Converto Co. have moved their general offices next to their new steel and aluminum fabricating plant at 51st St. & Allegheny Valley R. R., Pittsburgh.

terial from a steel mill. If they can get a quota of 200 tons of sheets per quarter from a steel mill, they have a priceless property. But today, they are in the position of possibly losing those mill quotas. They cannot get their licenses in time for the mills to roll in the given period. Yet the only way they can protect their quota is to take it up every month.

If the current pressure in Congress to throw out the price criteria in granting licenses is not successful, it will be the independent exporters who will suffer in the long pull.

In general, there has been a two price world market for steel during the past 2 years, just as there has been within the U. S. First, there has been a substantial world trade at levels slightly above published prices. The U. S. Steel Export Co. publishes its own prices on this basis regularly.

Britain has followed a similar policy on the small tonnage of steel it has been able to export. Belgium has followed the same policy on exports to certain countries where its government was forced to work out a trade agreement. This low quoted world price level has been mostly for a product that was not available.

In other words, while American or British firms quote these prices, no new customer has much chance of going to such a firm and saying, "I want 1000 tons of your sheet", and getting it. The quotas available for export are far too small for such a transaction.

If a potential steel user really has wanted to go into the open market for steel, and buy without any historical relationship, he has bought in a kind of international gray market. In this field, bucket shop American exporters were competing with high priced Belgian exports, both charging as much as the traffic would bear. The Commerce Dept. aims to squeeze these operators out.

There is a lot of discussion about the exact application of the price criteria in a lot of cases. The foreign government is to be a participant in consultations, but the Commerce Dept. may or may not follow their advice. As long as steel is in short supply, it is certain that some situations will occur where high priced steel is the only kind of steel that the foreign nation will be able to get.

Base Prices and Extras on Aluminum Sheet Move Upward

Small Orders Get Higher Prices; Large Orders To Get Better Discounts

By JOHN ANTHONY
Eastern Regional Editor

Philadelphia

• • • **Aluminum producers** have been quietly raising their base pices and readjusting their extras in recent months. Important increases in sheet products of Alcoa went into effect last month. Base price increases on many grades and gages of sheet were high, particularly in the wider sheet sizes. Extra revisions since the end of price control have been in the direction of lower charges on large orders and higher charges on small orders. A study of the revised extras indicates that the overall extra cost to consumers is much higher.

Sheet price increases were highest in the 52S grade, in which flat sheet increases ranged up to 9¢ per lb. coiled sheet up to 4.5¢, circles up to 5¢. Other grades in which important increases in base price were made include 2S and 3S. In mill finish, flat sheet increases ranged up to 2.6¢ per lb. coiled sheet up to 1.3¢, circles up to 5.3c. In bright finish, flat sheet increases ranged up to 4.2¢, coiled sheet up to 2.3c., circles up to 6.8¢. Increases in one side bright finish sheet were relatively low, in flat sheet up to 1.8¢, coiled sheet up to 1.3c., circles up to 1.4¢.

Lower base prices were established in a few sizes and gages of some grades of sheet. This action was principally the result of the broadening of the narrowest base width range to 48 in. from the former range to 24 or 26 in. In some instances the price has been lowered on the wider sheets in this range, but these reductions have been more than made up by increased cost to consumers for the narrower width sheets.

Base price increases have not been made in plates, except in 2S and 3S bright finish, in which increases ranged up to 2¢ per lb. Increases have not been made in 24S or 75S, or in Alclad 14S, 24S, or 75S, except for coiled sheet. Increases in 24S and Alclad 24S ranged up to 3.3¢ per lb; 75S and Alclad 75S, up to 7¢; Alclad 14S, upto 2.8¢.

All sheets and plates, including those whose base prices were not increased, are now subject to stiff increases in extra charges. Minimum sheet and plate lengths covered by base prices have been increased from 24 in. to 60 in. This has served to add another column of shearing extras for lengths 60 in. and over, and lengths of less than 12 in. have been placed on an inquiry basis. The wider spread in the narrowest sheet width range has served to add a new set of shearing extras for widths of 24 in. and over. Shearing extra charges have been increased as much as 100 pct on some lighter gages.

Slitting extras are now applicable to coiled sheet under 12 in. wide as compared with under 3 in. wide formerly, but this is a decrease in extras from the 1¢ per lb for 3 to 12 in. widths. New width breakdowns have been added to the slitting extras which have served to increase extra costs to consumers.

Some sizes and gages of sheets and plates have been placed on a mill standard size basis, for which quantity extras on items above 10,000 lb have been reduced. But on quantities between 2000 and 10,000 lb, extras on mill standard and nonstandard sizes have been increased. Quantity extras on items of less than 500 lb have all been increased, and the minimum quantity extra charge per mill item has been increased from $3.50 to $5.00.

Circle extras are applicable now for diameters under 12 in., compared with under 9 in. formerly. Diameters of less than 3 in. have been placed on an inquiry basis. Sawing extras have been doubled and the minimum charge has been raised to $2.00.

Other price increases have recently been made in standard structural shapes, extruded and drawn round tubing and pipe, forging stock, and wire, rod and bar.

Texas Pig Iron Brings Fancy Prices, Headaches

Chicago

• • • **Texas pig iron** reaching Chicago recently has cost so much the foundries declare it should be classed as precious and sold by the ounce. Last summer the trade thought that $57 a gross ton delivered for pig iron from Colorado Fuel & Iron delivered in Chicago was high, but lately iron from Daingerfield was delivered into Chicago at $100 a gross ton.

There are as many different prices on Texas iron as there are outlets who peddle the stuff. Currently the f.o.b. price claimed by brokers here, runs from $75 to $88. When Lone Star Steel was running on a subsidy the iron cost $36 plus a $12 grant, f.o.b. Daingerfield. After the subsidy was removed, Lone Star raised the price to $50 and now Chicago foundries report it is impossible to buy at less than $75 f.o.b. Texas.

Underwriting of the expensive Daingerfield operation by Ford Motor, Kaiser-Frazer and others, has complicated the picture. Users claim that Texas deliveries are even more inconsistent than the price. Larger buyers who are able to secure northern iron ore have worked out an agreement whereby their iron only costs $39.50 a gross ton f.o.b. Daingerfield. To make the confusion complete, this ore is not shipped to Texas, but is sent elsewhere and credited to the pig iron buyers account.

Net Earnings Decrease

Cleveland

• • • **Net profit** of National Malleable & Steel Castings Co. in 1947 was $527,372, equal to $1.11 a share on 474,861 common shares outstanding, Cleve H. Pomeroy, president, announced recently.

"Don't Let It Happen Again," Says Government to Steel Industry

Although Warning is Sounded, No Action is Taken as Investigations End

By GEORGE BAKER
Washington Bureau

Washington

• • • **The White House** last week called off the bloodhounds—for the time being—and announced the interim results of its investigations into the controversial price rises in semifinished steel.

The political outbursts contained in three agency reports were not unexpected. While advocates of government-financed expansion feel they have been given ammunition, the industry actually escapes with nothing more than a sound spanking and the warning "don't let it happen again."

President Truman's release of the price rise studies he requested last month includes the recommendations of three government agencies—the Council of Economic Advisers, the Commerce Dept., and the Justice Dept. Mr. Truman did not add his comment to that of his executive advisers. In essence, each of the agencies reported as follows:

Council of Economic Advisers: "Any general price increases will have to be defended strongly before the bar of public opinion."

Commerce Dept.: "Retained earnings of the steel producers have been below the amount necessary to cover their net plant and equipment expenditures."

Justice Dept.: "Completion of the investigation is necessary in order that a conclusion be reached."

The economic report—the most critical of the three—bluntly warned the industry that it is "futile" for the industry to issue a call for restraint in wage negotiations at the same time the industry is raising prices, "particularly when, according to the statements of steel companies, they will pass on any substantial wage increases granted to labor in still higher prices."

"Fortunately," the council told Mr. Truman, "the public attention aroused by your call for an investigation of the rise in semifinished steel prices has served notice on industry that any general price increase will have to be defended strongly before the bar of public opinion. Had it not been for this publicity, the rise in steel prices would undoubtedly have acted as an encouragement to others to proceed with price advances."

The council concluded with the significant remark that "all those who occupy strategic positions in the setting of prices, in the fixing of wages, and in the granting of credit must recognize the public interest in their private economic decisions in a way the steel industry has not shown in this instance. Up to this time, the evidence does not indicate that it was prudent to postpone action upon the principal feature of the anti-inflationary program which you proposed in November."

The Commerce Dept., taking a more businesslike view of the price rises, notes in a statement bulging with cost data that "the rate of return on investment for the steel companies appears to have been higher in 1947 than in any of the earlier years with exception of 1920 and 1929. This return, however, is calculated on the book value of investment, which is written down from the original cost and is far below present reproduction cost.

"The rate of return on sales for the primary iron and steel producers was lower in 1947 than in the twenties generally and was only half the 1929 rate," the Commerce Dept. continued. "It was also somewhat below the years 1937, 1940 and 1941. The lower ratio of profits to sales without a corresponding decline in the return on investment reflects the fact that dollar sales in 1947 were much higher in relation to the book value of investment."

The Justice Dept., reporting on its investigations of 16 producers, estimated that the total increase in sales prices of semifinished products "may be in the neighborhood of $30 million annually." The department continued, "It has become evident that, in addition to the completion of our investigation with respect to the price increases on semifinished products, thorough investigation is also required of industrywide increases in prices of other important steel products recently made, particularly the other substantial price increases since Jan. 1, 1948." An extended probe is necessary, the department said, in order to determine if the companies under investigation violated provisions of the antitrust laws.

Scrap Bill Sponsored By House Committee

Washington

• • • **A house committee** is sponsoring legislation to authorize U. S. acquisition of some of the estimated 10 million tons of scrap in Germany.

"We must arrive at some method of recouping the surplus scrap now overflowing in certain European scrap yards in order to bring about a substantial increase in steel production," Rep. Macy stated.

Earlier, Mr. Macy met with Walter S. Tower, president of the American Iron & Steel Institute, and R. W. Wolcott, chairman of the institute's scrap division. Mr. Tower stated that 1948 steel production will exceed 89 million ingot tons. Mr. Wolcott declared that if the German scrap were made available shipments to the U. S. could start in 2 weeks.

Two other congressional groups are considering identical bills to shake loose potential scrap from the Army, Navy, and War Assets Administration.

Proposes Payment Plan

Pittsburgh

• • • **G. G. Main,** assistant treasurer, Westinghouse Electric Corp., proposes a "pay-as-you-go" plan to buyers of large industrial machinery. Scarcity of private capital, high cost of borrowing and need for heavy inventories are listed as arguments from the manufacturers' viewpoint.

6 To 8 Million Tons Finished Steel Needed For 1948 Construction

Prices, Foreign Demand and Allocations Under Close Government Scrutiny

By KARL RANNELLS
Washington Bureau

Washington

• • • **On the basis** of present expected building activity in 1948, federal offices estimate that between six and eight million tons of finished steel products will be required for construction alone.

For this reason, housing and other federal works officials are closely watching the steel situation with an anxious eye, particularly any developments along the price line, foreign demand, and the move for allocation controls.

Current government estimates are that $15 billion worth of construction will go into place during 1948, a 20 pct. increase over 1947. Included in this figure is the completion of a million or more permanent type dwelling units; requirements for this category alone will take about 1.1 million tons of steel, they estimate.

Despite new production records in 1947, several of the metal building materials carried in the Commerce Dept. index are still in tight supply. The prospective 20 pct. increase in dollar volume of construction means that demands for actual materials will be 10 pct greater.

While iron and steel for building purposes ostensibly get priority, officials are increasingly aware that production is the ultimate key to the solution. Unless production is stepped up, some declare, shortages in some still critical building items are likely to become even more acute as the months pass.

Unfilled orders for pressure pipe, for instance, now stand at nearly a million tons—the equivalent of 11 months production at the present rate of output; also, the best estimate now available is that about a million tons of wire nails will be needed this year against production of about 825,000 tons at present rate of output.

Normally, the seasonal decline in construction activity gives producers a breathing spell for building up their supplies; however, according to preliminary FWA estimates, new construction in January 1948, while showing the normal seasonal decline, was a third higher for the month than last year. Construction in 1947, however, got off to a bad start.

This slowness in getting under way was variously attributed to scarcities and higher costs of labor and materials. This tended to create a lack of confidence as to a market for higher-cost dwellings. According to the BLS, prices of building materials as a whole increased 107 pct (as of December) since 1939; during the same period, average hourly earnings in private construction advanced 88 pct.

That material scarcities, rather than costs, were the main delaying factors is seen in the continued ability of builders to peddle their housing regardless of price. Their renewed confidence in the market, as well as increased channeling of materials to housing, was reflected in the increased number of starts during the last half of 1947. These rose to 90,000 monthly in September and October.

Six of the estimated $15 billion total for this year is expected to be accounted for by residential construction, exclusive of farm building. This sum represents an increase of a fifth over 1947 nonfarm residential building when 855,000 new starts and 835,000 completions were made (including carry-overs from 1946).

On the basis of a 10 pct or more increase in physical construction, the goal of 1 million housing units appears possible of attainment—providing materials are available in needed amounts.

"It is clear from our data," Commerce officials say, "that the available supply of many building materials will need to be stepped up sharply during 1948 if the additional demand is to be met. Several construction materials remain in tight supply and these shortages are likely to become even more acute unless production is further increased."

Officials of FWA are slightly more optimistic, however. They expect the seasonal decline in demand to somewhat ease procurement problems.

"Shortages are still reported for nails, pipe, plumbing materials and metal products where steel sheet and strip are involved," they admit. "Spot shortages of other materials are reported in specific areas. Nevertheless, it is expected that these will ease with a continuation of production at or near present rates."

Back of Commerce's thinly-veiled pessimism is the critical supply picture for a few major items, the lack of any one of which at a given time necessarily delays construction, particularly housing. Year-end governmental surveys present the following general picture for these:

Wire Nails. It is estimated that a million tons will be required for 1948. Consumption for construction alone during 1947 required 722,000 tons, leaving about 100,000 tons for all other purposes. At current rates, about 825,000 tons would be produced in 1948. With production down somewhat at the end of the year, the industry was booked well into the second quarter.

Cast Iron Soil Pipe. Soil pipe appeared to be moving into an easier position; although demands were up 35 pct, November shipments were up nearly 50 pct over the previous year. Residential building will require about 405,000 tons, leaving about 175,000 tons of estimated 1948 supply for other construction needs. As yet, however, unfilled order backlogs show little tendency to decrease.

Cast Iron Radiation. Production in 1947 (including convectors) continued far ahead of 1946 although a last quarter decline resulted in a severe drain on stocks. Stocks were down to about 2.5 million sq ft at the begining of December. About 22.5 million sq ft more will be needed in 1948 than last year.

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UNITED STATES STEEL

SCRAP

Movement Still Easy At Formula

New York

• • • **Lots of scrap** continued to move at formula prices and most markets showed comparative balance with incoming shipments hitting highs for the year.

There were not many new orders placed as most brokers are still short and delivering on previous commitments. The one sizeable order reported on was, as expected, at formula.

Most buyers apparently look for the spring influx of material to protect them and seem certain the formula will be a ceiling price for two months at least with no trouble in getting delivery. Hence they are not going overboard on orders yet. April 1st will be a deadline for many of the mills with substantial requirements, however, so a more certain price line should be available then.

Cast grades continued to be the strongest items, but most foundries apparently are better fixed than they dreamed of being a month ago.

There were indications last week that some foundry buyers might resist the present quotations, but that movement has not become widespread or made any headway. In fact Buffalo prices on foundry grades recovered the $5 break reported three last week.

Chicago reported no further weakness in No. 2 steel and no tendency for weakness in the lighter material, which some sources expected to spread to other markets, has been evidenced.

Warm weather has helped receipts but has also led to an influx from marginal sources resulting in some "off grade" material being received and shipped. As a result buyers' rejections have been running high, but nobody is being blamed as the situation is understood by all involved, and the buyers would rather have to return scrap occasionally than not to have the larger quantities moving.

PITTSBURGH — Shipments have improved considerably in the past 2 weeks and mill inventories are generally reported to be better than they were a month ago. Mill efforts to drive prices of turnings down to formula levels are beginning to meet with success. A little weakness in low phos is also evident. Dealer stocks are said to be growing, but they are having difficulty getting cars. Main reason for the car shortage here is believed to be the sharp increase in incoming shipments in the past 2 weeks with a consequent slowdown in routing and unloading of cars. Cast iron prices showed no signs of weakness.

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CHICAGO—New buying is not expected until the first of April or shortly thereafter. Shipments have been heavy and all mills report inventories have been bolstered substantially. Railroad prices did not change materially on the lists closed last week. Foundry cast items are still bringing high prices and this particular market is the only one which does not show signs of weakness.

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PHILADELPHIA—Mills placed on new orders for heavy melting grades last week and the market is firm at previously quoted prices. Mills are out of the market expecting spring weather to bring out larger tonnages and weaken prices. Tonnages moving on old orders are reported to be increasing. One mill is reported to have converted to consumption of No. 2 bundles instead of No. 2 melting. Cast grades are firm and pipe foundries are required to pay the high quoted prices for yard cast.

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CLEVELAND—This area's shortages of scrap is again very evident. Snow storms have slowed up shipments and all grades are strong. Consumers large and small are more than willing to take everything they can get at formula prices, and there are rumors of broker-buying at more than formula as an expedient to get shipments. The market here and in the Valley is certainly not over the formula, but it is plenty vulnerable. Ordinarily, the reecnt break in the commodity market would have broken the scrap price $10. The fact that scrap prices are virtually unaffected points up pretty clearly that the shortage of scrap is no seasonal myth.

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DETROIT—Market sentiment in Detroit continues on the weak side with local buying offsetting any tendency toward price weakness. Reports of over-the-formula deals have dwindled to a whisper. Recent rejections by out-of-town buyers have also contributed to a stay-at-home tendency for Detroit scrap. Shipments in good volume are reported despite adverse weather conditions.

BIRMINGHAM—Cast iron consumers are showing an increasing reluctance to purchase material at asking prices. Most of the consumers either are reducing orders or are out of the market. Open hearth grades are moving freely at formula prices.

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BUFFALO—One of the leading consumers last week placed orders with local dealers for a substantial tonnage of open hearth and blast furnace scrap at the formula prices—$39.75 for No. 2 steel and bundles and $34.75 for mixed borings and turnings. This new business effectively put the quietus on talk of below ceiling sales. Scrap supplies admittedly are increasing, but most of the improvement consists of "off grade" material giving rise to a heavier rate of rejections. Cast grades fully recovered the $5 loss reported last week.

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NEW YORK—Again there is considerable activity and no change in prices. Demand is strong but receipts are up sufficiently to give a balanced market. Cast grades continue to show strength but incoming shipments of these items have been particularly good.

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BOSTON—Busheling, turnings and borings very active, at formula prices. Big demand for cast at $60 locally, $65 outside Boston and $73 on long hauls. For chemical borings $36 is common.

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ST. LOUIS—Heavy snow and extremely cold weather halted the movement of scrap into the St. Louis market and interfered with fabrication here.

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CINCINNATI — Foundry grades are meeting increased price resistance, as some of the major consumers are either out of the market temporarily or unwilling to pay what brokers are asking. Open-hearth material, much of it bought in remote areas, is moving pretty well, and consumers are continuing to take all they can get at formula prices.

•

TORONTO—Scrap supply is the chief problem to Canadian steel mills and foundries, and the question now arises as to whether steelmakers will be able to maintain the present high production schedule for any long period into the future. As a result of large importations last year steel mills have fairly good supplies at this time but there is doubt that they will be able to maintain large tonnage receipts in the future. Much of the scrap used in the mills has been coming from the wrecking of old ships but this source of supply is steadily drying up. Domestic supply of scrap is limited and dealers in Canada are supplying less than 25 pct of requirements at this time. Some improvement is hoped for in the late spring when collections can be made in farm communities. In the meantime practically all scrap is coming from industrial plants.

Going prices as obtained in the trade by THE IRON AGE, based on representative tonnages.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. melting	$40.00 to $40.50
RR. hvy. melting	41.00 to 41.50
No. 2 hvy. melting	40.00 to 40.50
RR. scrap rails	54.00 to 55.00
Rails 2 ft and under	59.00 to 60.00
No. 1 comp'd bundles	40.00 to 40.50
Hand bdld. new shts	40.00 to 40.50
Hvy. axle turn.	41.50 to 42.00
Hvy. steel forge turn	41.50 to 42.00
Mach. shop turn	35.00 to 35.50
Shoveling turn.	37.50 to 38.00
Mixed bor. and turn	35.00 to 35.50
Cast iron boring	37.50 to 38.00
No. 1 cupola cast.	60.00 to 62.00
Hvy. breakable cast	51.00 to 52.00
Malleable	77.00 to 79.00
RR. knuck. and coup	54.00 to 54.50
RR. coil springs	54.00 to 54.50
RR. leaf springs	54.00 to 54.50
Rolled steel wheels	54.00 to 54.50
Low phos.	47.00 to 47.50

CHICAGO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$38.50 to $39.50
No. 2 hvy. melting	37.00 to 37.50
No. 1 bndules	38.50 to 39.50
No. 2 dealers' bundles	37.00 to 37.50
Bundled mach. shop turn.	37.00 to 37.50
Galv. bundles	35.00 to 35.50
Mach. shop turn.	33.50 to 34.50
Short shov. turn.	35.00 to 36.50
Cast iron borings	34.50 to 35.50
Mix. borings & turn	33.50 to 34.50
Low phos. hvy. forge	44.00 to 48.00
Low phos. plates	42.50 to 46.00
No. 1 RR. hvy. melt	41.25 to 41.75
Rerolling rails	49.50 to 50.00
Miscellaneous rails	48.00 to 50.00
Angles & splice bars	49.00 to 52.00
Locomotive tires, cut	50.00 to 52.00
Cut bolster & side frames	47.00 to 48.00
Standard stl. car axles	54.00 to 57.00
No. 3 steel wheels	46.00 to 50.00
Couplers & knuckles	47.00 to 49.00
Rails, 2 ft and under	54.00 to 56.00
Malleable	70.00 to 72.00
No. 1 mach. cast.	68.00 to 70.00
No. 1 agricul. cast.	63.00 to 64.00
Heavy breakable cast.	50.00 to 52.00
RR. grate bars	56.00 to 58.00
Cast iron brake shoes	55.00 to 57.00
Cast iron carwheels	57.00 to 58.00

CINCINNATI

Per gross ton delivered to consumer:

No. 1 hvy. melting	$38.50 to $39.50
No. 2 hvy. melting	38.50 to 39.50
No. 1 bundles	38.50 to 39.50
No. 2 bundles	38.50 to 39.50
Mach. shop turn.	33.00 to 33.50
Shoveling turn.	35.00 to 35.50
Cast iron borings	32.50 to 33.00
Mixed bor. & turn	32.50 to 33.00
Low phos., plate	46.00 to 48.00
No. 1 cupola cast	63.00 to 64.00
Hvy. breakable cast	53.00 to 54.00
Rails 18 in. & under	59.00 to 60.00
Rails random length	51.00 to 52.00
Drop broken	66.00 to 68.00

BOSTON

Dealers' buying prices per gross ton, f.o.b. cars:

No. 1 hvy. melting	$31.65 to $31.90
No. 2 hvy. melting	31.65 to 31.90
Nos. 1 and 2 bundles	31.65 to 31.90
Busheling	31.65 to 31.90
Shoveling turn.	.... 28.90
Machine shop trun.	.... 26.90
Mixed bor. & turn.	.... 26.90
Cl'n cast. chem. bor.	.... 36.00
No. 1 machinery cast	60.00 to 65.00
No. 2 machinery cast	60.00 to 65.00
Heavy breakable cast	60.00 to 65.00
Stove plate	50.00 to 55.00

DETROIT

Per gross ton, brokers' buying prices f.o.b. cars:

No. 1 hvy. melting	.... $35.50
No. 2 hvy. melting	.... 35.50
No. 1 bundles	.... 35.50
New busheling	.... 35.50
Flashings	.... 35.50
Mach. shop turn.	$29.00 to 29.50
Shoveling turn.	30.00 to 30.50
Cast iron borings	30.00 to 30.50
Mixed bor. & turn.	28.50 to 29.00
Low phos. plate	39.50 to 40.50
No. 1 cupola cast.	60.00 to 62.00
Heavy breakable cast.	52.00 to 55.00
Stove plate	52.00 to 55.00
Automotive cast.	60.00 to 62.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. melting	$39.50 to $40.50
No. 2 hvy. melting	37.00 to 38.00
No. 1 bundles	37.00 to 38.00
No. 1 bundles	38.00 to 39.00
Mach. shop turn.	33.00 to 34.00
Shoveling turn.	33.00 to 34.00
Mixed bor. & turn.	33.00 to 34.00
Clean cast chemical bor.	40.00 to 42.00
No. 1 machinery cast	65.00 to 66.00
No. 1 mixed yard cast	63.00 to 65.00
Hvy. breakable cast.	59.00 to 60.00
Clean auto cast.	63.00 to 65.00
Hvy. axle forge turn	39.50 to 40.50
Low phos. plate	44.50 to 45.50
Low phos. punchings	44.50 to 45.50
Low phos. bundles	43.00 to 44.00
RR. steel wheels	51.00 to 52.00
RR. coil springs	51.00 to 52.00
RR. malleable	72.00 to 75.00

ST. LOUIS

Per gross ton delivered to consumer:

No. 1 hvy. melting	$41.00 to $42.00
No. 2 hvy. melting	37.50 to 38.50
Bundled sheets	37.50 to 38.50
Mach. shop turn.	33.00 to 33.50
Locomotive tires, uncut	46.00 to 48.00
Mis. std. sec. rails	48.00 to 50.00
Rerolling rails	50.00 to 51.00
Steel angle bars	57.00 to 58.00
Rails 3 ft and under	53.00 to 55.00
RR. steel springs	48.00 to 50.00
Steel car axles	48.00 to 50.00
Grate bars	56.00 to 57.00
Brake shoes	54.00 to 55.00
Malleable	71.00 to 72.00
Cast iron car wheels	54.00 to 55.00
No. 1 machinery cast	64.00 to 65.00
Hvy. breakable cast	52.00 to 53.00

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting	$37.50 to $38.50
No. 2 hvy. melting	37.50 to 38.50
No. 2 bundles	37.50 to 38.50
No. 1 busheling	37.50 to 38.50
Long turnings	25.00 to 26.00
Shoveling turnings	27.00 to 28.00
Cast iron borings	26.00 to 27.00
Bar crops and plate	42.50 to 43.50
Structural and plate	42.50 to 43.50
No. 1 cupola cast.	60.00 to 65.00
Stove plate	55.00 to 58.00
No. 1 RR. hvy. melt.	37.50 to 38.50
Steel axles	38.00 to 39.00
Scrap rails	44.00 to 45.00
Rerolling rails	52.00 to 54.00
Angles & splice bars	47.50 to 50.00
Rails 3 ft & under	52.00 to 56.00
Cast iron carwheels	48.00 to 50.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. melting	$40.00 to $40.50
No. 2 hvy. melting	40.00 to 40.50
Mach. shop turn.	35.00 to 35.50
Short shov. turn.	37.00 to 37.50
Cast iron borings	36.00 to 36.50
Low phos.	45.00 to 45.50

NEW YORK

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	.... $34.50
No. 2 hvy. melting	.... 34.50
No. 2 bundles	.... 34.50
Comp. galv. bundles	$30.50 to 31.50
Mach. shop turn.	29.00 to 30.00
Mixed bor. & turn.	29.00 to 30.00
Shoveling turn.	31.00 to 32.00
No. 1 cupola cast.	60.00 to 61.00
Clean auto cast.	60.00 to 61.00
Hvy. breakable cast.	55.00 to 56.00
Charging box cast.	55.00 to 56.00
Stove plate	51.00 to 52.00
Unstrp. motor blks.	50.00 to 51.00
Cl'n chem. cast bor.	34.50 to 35.50

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$43.00 to $45.00
No. 2 hvy. melting	.... 39.75
No. 1 bundles	.... 39.75
No. 2 bundles	.... 39.75
No. 1 busheling	.... 39.75
Mach. shop turn.	34.75 to 35.25
Shoveling turn.	36.75 to 37.25
Cast iron borings	.... 35.75
Mixed bor. & turn.	.... 34.75
Mixed cupola cast.	60.00 to 62.00
Charging box cast.	54.00 to 55.00
Stove plate	58.00 to 60.00
Clean auto cast.	62.00 to 65.00
RR. malleable	70.00 to 75.00
Small indl. malleable	47.00 to 49.00
Low phos. plate	44.75 to 48.00
Scrap rails	58.00 to 59.00
Rails 3 ft & under	60.00 to 61.00
RR. steel wheels	51.00 to 52.00
Cast iron carwheels	51.00 to 52.00
RR. coil & leaf spgs	51.00 to 52.00
RR. knuckles & coup	51.00 to 52.00

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. melting	$39.50 to $40.00
No. 2 hvy. melting	39.50 to 40.00
No. 1 bundles	39.50 to 40.00
No. 1 busheling	39.50 to 40.00
Drop forge flashings	39.50 to 40.00
Mach. shop turn.	34.50 to 35.00
Shoveling turn.	35.50 to 36.00
Steel axle turn.	39.50 to 40.00
Cast iron borings	35.50 to 36.00
Mixed bor. & turn.	35.50 to 36.00
Low phos.	44.50 to 45.00
No. 1 machinery cast.	65.00 to 70.00
Malleable	75.00 to 80.00
RR. cast.	70.00 to 73.00
Railroad grate bars	60.00 to 62.00
Stove plate	60.00 to 62.00
RR. hvy. melting	40.00 to 40.50
Rails 3 ft & under	60.00 to 61.00
Rails 18 in. & under	61.00 to 62.00

SAN FRANCISCO

Per gross ton f.o.b. shipping point:

No. 1 hvy. melting	.... $25.00
No. 2 hvy. melting	.... 25.00
No. 2 bales	.... 25.00

Per gross ton delivered to consumer:

No. 3 bales	.... $19.50
Mach. shop turn.	.... 16.00
Elec. furn. 1 ft under	$32.00 to 34.00
No. 1 cupola cast.	34.00 to 37.00
RR. hvy. melting	.... 26.00

LOS ANGELES

Per gross ton delivered to consumer:

No. 1 hvy. melting	.... $25.50
No. 2 hvy. melting	.... 25.50
No. 1 bales	.... 25.50
No. 2 bales	.... 25.50
No. 3 bales	.... 19.50
Mach. shop turn.	.... 17.50
No. 1 cupola cast.	$40.00 to 43.00
RR. hvy. melting	.... 26.50

SEATTLE

Per gross ton delivered to consumer:

No. 1 & No. 2 hvy. melt	.... $26.00
Elec. furn. 1 ft and under	.... 30.00
No. 1 cupola cast.	40.00 to 42.00
RR. hvy. melting	.... 30.00

HAMILTON, ONT.

Per gross ton delivered to consumer: Cast grades f.o.b. shipping point.

Heavy melting	$22.00*
No. 1 bundles	22.00*
No. 2 bundles	21.50*
Mechanical bundles	20.00*
Mixed steel scrap	19.00*
Mixed borings and turnings	17.00*
Rails, remelting	23.00*
Rails, rerolling	26.00*
Bushelings	17.00*
Bushelings, new fact, prep'd	21.00*
Bushelings, new fact, unprep'd	16.00*
Short steel turnings	17.00*
No. 1 cast	$42.00 to 43.00
No. 2 cast	35.00 to 37.00

*Ceiling Price.

Comparison of Prices . .

Advances over past week in **Heavy Type**, declines in *Italics*. Prices are f.o.b. major basing points. The various basing points for finished and semifinished steel are listed in the detailed price tables.

Flat-Rolled Steel: (cents per pound)	Mar. 16, 1948	Mar. 9, 1948	Feb. 17, 1948	Mar. 18, 1947
Hot-rolled sheets	2.80	2.80	2.80	2.50
Cold-rolled sheets	3.55	3.55	3.55	3.20
Galvanized sheets (10 ga.)	3.95	3.95	3.95	3.55
Hot-rolled strip	2.80	2.80	2.80	2.50
Cold-rolled strip	3.55	3.55	3.55	3.20
Plates	2.95	2.95	2.95	2.65
Plates wrought iron	7.25	7.25	7.25	5.95
Stain's c-r strip (No. 302)	30.50	30.50	30.50	30.50
Tin and Terneplate: (dollars per base box)				
Tinplate (1.50 lb) cokes.	$6.80	$6.80	$6.80	$5.75
Tinplate, electro (0.50 lb)	6.00	6.00	6.00	5.05
Special coated mfg. ternes	5.90	5.90	5.90	4.90
Bars and Shapes: (cents per pound)				
Merchant bars	2.90	2.90	2.90	2.60
Cold-finished bars	3.55	3.55	3.55	3.20
Alloy bars	3.30	3.30	3.30	3.05
Structural shapes	2.80	2.80	2.80	2.50
Stainless bars (No. 302)	26.00	26.00	26.00	26.00
Wrought iron bars	8.65	8.65	8.65	6.15
Wire: (cents per pound)				
Bright wire	3.55	3.55	3.55	3.30
Rails: (dollars per 100 lb)				
Heavy rails	$2.75	$2.75	$2.75	$2.50
Light rails	3.10	3.10	3.10	2.85
Semifinished Steel: (dollars per gross ton)				
Rerolling billets	$45.00†	$45.00†	$45.00	$42.00
Slabs, rerolling	45.00†	45.00†	45.00	42.00
Forging billets	54.00†	54.00†	55.00	50.00
Alloy blooms, billets, slabs	66.00	66.00	66.00	61.00
Wire Rods and Skelp: (cents per pound)				
Wire rods	2.80	2.80	2.80	2.55
Skelp	2.90	2.90	2.60	2.35

†Net ton

Pig Iron: (per gross ton)	Mar. 16, 1948	Mar. 9, 1948	Feb. 17, 1948	Mar. 18, 1947
No. 2, foundry, Phila.	$44.61	$44.61	$44.61	$36.51
No. 2, Valley furnace	39.50	39.50	39.50	33.50
No. 2, Southern Cin'ti	43.28	43.28	43.28	34.75
No. 2, Birmingham	37.38	37.38	37.38	29.88
No. 2, foundry, Chicago†	39.00	39.00	39.00	33.00
Basic del'd Philadelphia	44.11	44.11	44.11	36.92
Basic, Valley furnace	39.00	39.00	39.00	33.00
Malleable, Chicago†	39.50	39.50	39.50	33.50
Malleable, Valley	39.50	39.50	39.50	33.50
Charcoal, Chicago	62.46	62.46	62.46	45.99
Ferromanganese‡	145.00	145.00	145.00	135.00

† The switching charge for delivery to foundries in the Chicago district is $1 per ton.
‡ For carlots at seaboard.

Scrap: (per gross ton)				
Heavy melt'g steel, P'gh.	$40.25	$40.25	$40.50	$41.00
Heavy melt'g steel, Phila.	40.00	40.00	41.00	40.75
Heavy Melt'g steel, Ch'go	39.00	39.00	38.75	37.25
No. 1, hy. comp. sheet, Det.	35.50	35.50	35.50	35.00
Low phos. Young'n	45.25	45.25	45.25	45.25
No. 1, cast, Pittsburgh	61.00	61.00	59.50	44.50
No. 1, cast, Philadelphia	65.00	65.50	65.50	50.00
No. 1, cast, Chicago	69.00	69.00	65.50	46.50
Coke, Connellsville: (per net ton at oven)				
Furnace coke, prompt	$12.50	$12.50	$12.50	$9.00
Foundry coke, prompt	14.00	14.00	14.00	10.25
Nonferrous Metals: (cents per pound to large buyers)				
Copper, electro, Conn.	21.50	21.50	21.50	21.50
Copper, Lake Conn.	21.625	21.625	21.625	21.625
Tin, Grade A, New York	94.00	94.00	94.00	70.00
Zinc, East St. Louis	12.00	12.00	12.00	10.50
Lead, St. Louis	14.80	14.80	14.80	14.80
Aluminum, virgin	15.00	15.00	15.00	15.00
Nickel, electrolytic	36.56	36.56	36.56	37.67
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	33.00	33.00	33.00	33.00

Composite Prices . .

Starting with the issue of Apr. 22, 1943, the weighted finished steel index was revised for the years 1941, 1942, and 1943. See explanation of the change on p. 90 of the Apr. 22, 1943, issue. Index revised to a quarterly basis as of Nov. 16, 1944; for details see p. 98 of that issue. The finished steel composite price for the current quarter is an estimate based on finished steel shipments for the previous quarter. This figure will be revised when shipments for this quarter are compiled.

	FINISHED STEEL (Base Price)	PIG IRON	SCRAP STEEL
Mar. 16, 1948	3.23940¢ per lb.	$40.29 per gross ton	$39.75 per gross ton
One week ago	3.23940¢ per lb.	$40.37 per gross ton	$39.75 per gross ton
One month ago	3.23940¢ per lb.	$40.37 per gross ton	$40.08 per gross ton
One year ago	2.86354¢ per lb.	$33.15 per gross ton	$39.67 per gross ton

	HIGH	LOW
1948	3.23940¢ Feb. 17	3.19411¢ Jan. 6
1947	3.19411¢ Oct. 7	2.87118¢ Jan. 7
1946	2.83599¢ Dec. 31	2.54490¢ Jan. 1
1945	2.44104¢ Oct. 2	2.38444¢ Jan. 2
1944	2.30837¢ Sept. 5	2.21189¢ Oct. 5
1943	2.29176¢	2.29176¢
1942	2.28249¢	2.28249¢
1941	2.43078¢	2.43078¢
1940	2.30467¢ Jan. 2	2.24107¢ Apr. 16
1939	2.35367¢ Jan. 3	2.26689¢ May 16
1938	2.58414¢ Jan. 4	2.27207¢ Oct. 18
1937	2.58414¢ Mar. 9	2.32263¢ Jan. 4
1936	2.32263¢ Dec. 28	2.05200¢ Mar. 10
1935	2.07642¢ Oct. 1	2.06492¢ Jan. 8
1934	2.15367¢ Apr. 24	1.95757¢ Jan. 2
1933	1.95578¢ Oct. 3	1.75836¢ May 2
1932	1.89196¢ July 5	1.83901¢ Mar. 1
1931	1.99626¢ Jan. 13	1.86586¢ Dec. 29
1930	2.25488¢ Jan. 7	1.97319¢ Dec. 9
1929	2.31773¢ May 28	2.26498¢ Oct. 29

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing major portion of finished steel shipments. Index recapitulated in Aug. 28, 1941, issue.

	HIGH	LOW
1948	$40.37 Feb. 17	$39.58 Jan. 6
1947	37.98 Dec. 30	30.14 Jan. 7
1946	30.14 Dec. 10	25.37 Jan. 1
1945	25.37 Oct. 23	23.61 Jan. 2
1944	$23.61	$23.61
1943	23.61	23.61
1942	23.61	23.61
1941	$23.61 Mar. 20	$23.45 Jan. 2
1940	23.45 Dec. 23	22.61 Jan. 2
1939	22.61 Sept. 19	20.61 Sept. 12
1938	23.25 June 21	19.61 July 6
1937	23.25 Mar. 9	20.25 Feb. 16
1936	19.74 Nov. 24	18.73 Aug. 11
1935	18.84 Nov. 5	17.83 May 14
1934	17.90 May 1	16.90 Jan. 27
1933	16.90 Dec. 5	13.56 Jan. 3
1932	14.81 Jan. 5	13.56 Dec. 6
1931	15.90 Jan. 6	14.79 Dec. 15
1930	18.21 Jan. 7	15.90 Dec. 16
1929	18.71 May 14	18.21 Dec. 17

Based on averages for basic iron at valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

	HIGH	LOW
1948	$41.83 Jan. 29	$39.75 Mar. 9
1947	42.58 Oct. 28	29.50 May 20
1946	31.17 Dec. 24	19.17 Jan. 1
1945	19.17 Jan. 2	18.92 May 22
1944	19.17 Jan. 11	15.76 Oct. 24
1943	$19.17	$19.17
1942	19.17	19.17
1941	$22.00 Jan. 7	$19.17 Apr. 10
1940	21.83 Dec. 30	16.04 Apr. 9
1939	22.50 Oct. 3	14.08 May 16
1938	15.00 Nov. 22	11.00 June 7
1937	21.92 Mar. 30	12.67 June 9
1936	17.75 Dec. 21	12.67 June 8
1935	13.42 Dec. 10	10.33 Apr. 29
1934	13.00 Mar. 13	9.50 Sept. 25
1933	12.25 Aug. 8	6.75 Jan. 3
1932	8.50 Jan. 12	6.43 July 5
1931	11.33 Jan. 6	8.50 Dec. 29
1930	15.00 Feb. 18	11.25 Dec. 9
1929	17.58 Jan. 29	14.08 Dec. 8

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Iron and Steel Prices . . .

Steel prices shown here are f.o.b. basing points in cents per pound or dollars per gross ton unless otherwise indicated. Extras apply. Delivered prices do not reflect 3 pct tax on freight. Industry practice has discontinued arbitrary f.o.b. prices at Gulf and Pacific Ports. Space limitations prevent quotation of delivered prices at major ports. (1) Commercial quality sheet grade; primes, 25¢ above base. (2) Commercial quality grade. (3) Widths up to 12-in. inclusive. (4) 0.25 carbon and less. (5) Cokes, 1.25 lb, deduct 20¢ per base box. (6) For merchant trade. (7) For straight length material only from producers to fabricators. (8) Also shafting. For quantities of 40,000 lb & over. (9) Carload lot in manufacturing trade. (10) Delivered Los Angeles only. (11) Hollowware enameling, gages 29 to 31 only. (12) Produced to dimensional tolerances in AISI Manual Sec. 6. (13) Delivered San Francisco only. (14) Kaiser Co. prices (15) to 0.035 to 0.075 in. thick by ¾ to 3½ in. wide. (16) Delivered Los Angeles; add ½¢ per 100 lb for San Francisco. (17) Slab prices subject to negotiation in most cases. Some producers charge (18) $2 more. (19) $1 per ton more. (20) One Chicago producer charges 0.30¢ more. (21) Some producers charge 0.40¢ less.

Basing Points	Pitts-burgh	Chicago	Gary	Cleve-land	Birm-ingham	Buffalo	Youngs-town	Spar-rows Point	Granite City	Middle-town, Ohio		San Franc'co, Los Angeles, Seattle	DELIVERED TO Detroit	New York	Phila-delphia
INGOTS Carbon, rerolling	($36.00 per net ton f. o. b. mill) (Spot market as high as $75 to $90 gross ton)														
Carbon, forging	$46.00	(per net ton)													
Alloy	$56.00									(Canton = $56.00)					
BILLETS, BLOOMS, SLABS Carbon, rerolling[17]	$45.00[18]	$45.00[18]	$45.00[18]	$47.00	$45.00[18]	$45.00[18]	(per net ton)								
Carbon, forging billets	$54.00	$54.00	$54.00	$54.00	$54.00	$54.00	(per net ton)								
Alloy	$66.00	$66.00				$66.00	(Bethlehem, Massillon, Canton = $66.00)								
SHEET BARS								Subject to negotiation							
PIPE SKELP	2.90¢						2.90¢								
WIRE RODS	2.60¢[19]	2.80¢		2.80¢	2.85¢		(Worcester = 2.90¢)					3.52¢[13]			
SHEETS Hot-rolled	2.80¢	2.80¢	2.80¢	2.80¢	2.80¢	2.80¢	2.80¢	2.80¢		(Ashland, Ky. = 2.80¢)		3.54¢[16]	2.96¢	3.148¢	3.040¢
Cold-rolled[1]	3.55¢	3.55¢	3.55¢	3.55¢		3.55¢	3.55¢		3.65¢	3.55¢			3.71¢	4.00¢	4.016¢
Galvanized (10 gage)	3.95¢	3.95¢	3.95¢		3.95¢		3.95¢	3.95¢	4.05¢	3.95¢	(Ashland = 3.95¢)	4.62¢[16]		4.298¢	4.190¢
Enameling (12 gage)	3.95¢	3.95¢	3.95¢	3.95¢			3.95¢		4.05¢	3.95¢			4.11¢	4.466¢	4.406¢
Long ternes[3] (10 gage)	4.05¢		4.05¢											4.566¢	4.506¢
STRIP Hot-rolled[3]	2.80¢	2.80¢[20]	2.80¢	2.80¢[15]	2.80¢		2.80¢					3.60¢[16]	2.96¢	3.316¢	3.256¢
Cold-rolled[4]	3.55¢	4.05[21]	3.65¢	3.55¢			3.55¢			(Worcester = 3.75¢)			3.71¢	4.066¢	4.006¢
Cooperage stock	3.10¢	3.10¢			3.10¢		3.10¢							3.616¢	
TINPLATE Cokes, 1.50 lb[5], base box	$6.80	$6.80	$6.80		$6.90			$6.90	$6.90	(Warren, Ohio = $6.80)				$7.248	$7.140
Electro, box 0.25 lb	Deduct $1.00 from 1.50 lb coke base box price.														
Electro, box 0.50 lb	Deduct 80¢ from 1.50 lb coke base box price.														
Electro, box 0.75 lb	Deduct 60¢ from 1.50 lb coke base box price.														
TERNES, MFG., special coated	Deduct 90¢ from 1.50 lb coke base box price.														
BLACKPLATE, CANMAKING 55 lb to 70 lb	Deduct $1.60 from 1.50 lb coke base box.														
BLACKPLATE, CANMAKING 75 lb to 95 lb	Deduct $1.70 from 1.50 lb coke base box.														
BLACKPLATE, CANMAKING 100 lb to 128 lb	Deduct $1.60 from 1.50 lb coke base box.														
BLACKPLATE, h. e. 29 ga[11]	4.75¢	4.75¢	4.75¢		4.85¢			4.85¢	4.85¢					5.198¢	5.090¢
BARS Carbon steel	2.90¢	2.90¢	2.90¢	2.90¢	2.90¢	2.90¢	2.90¢					3.625¢[16]	3.06¢	3.35¢	3.356¢
Rail steel[6]	Subject to negotiation because of fluctuating scrap prices.														
Reinforcing (billet)[7]	2.75¢	2.75¢	2.75¢	2.75¢	2.75¢	2.75¢	2.75¢	2.75¢				3.325¢[16]		3.098¢	2.990¢
Reinforcing (rail)	Subject to negotiation because of fluctuating scrap prices.														
Cold-finished[8]	3.55¢	3.55¢	3.55¢	3.55¢		3.55¢							3.71¢	4.00¢	4.006¢
Alloy, hot-rolled	3.30¢	3.30¢	3.30¢			3.30¢	3.30¢	(Bethlehem, Massillon, Canton = 3.30¢)							3.432¢
Alloy, cold-drawn	4.10¢	4.10¢	4.10¢	4.10¢		4.10¢			(Canton = 4.10¢)						
PLATE Carbon Steel[13]	2.95¢	2.95¢	2.95¢	2.95¢	2.95¢		2.95¢	(Coatesville = 3.45¢, Claymont = 3.65¢, Geneva, Utah = 3.10¢) 2.95¢				3.838¢[14]		3.298¢	3.190¢
Floor plates	4.20¢	4.20¢		4.20¢										4.716¢	4.656¢
Alloy	3.80¢	3.80¢	3.80¢		(Coatesville = 4.80¢)									4.316¢	4.256¢
SHAPES, Structural	2.80¢	2.80¢	2.80¢		2.80¢	2.80¢	(Geneva, Utah = 2.95¢, Bethlehem = 2.80¢)					3.43¢[19]		3.040¢	2.932¢
SPRING STEEL, C-R 0.08 to 0.40 carbon	3.55¢			3.55¢			(Worcester = 3.75¢)								
0.41 to 0.60 carbon	5.05¢			5.05¢			(Worcester = 5.25¢)								
0.61 to 0.80 carbon	5.65¢			5.65¢			(Worcester = 5.85¢)								
0.81 to 1.05 carbon	7.15¢			7.15¢			(Worcester = 7.35¢)								
1.06 to 1.35 carbon	9.45¢			9.45¢			(Worcester = 9.65¢)								
MANUFACTURERS' WIRE[9] Bright	3.55¢	3.55¢		3.55¢	3.55¢		(Worcester = 3.65¢, Duluth = 3.60¢)					4.56¢[13]		4.022¢	4.006¢
Galvanized	Add proper size extra and galvanizing extra to Bright Wire Base														
Spring (high carbon)	4.60¢	4.60¢		4.60¢	(Worcester = 4.70¢, Duluth = 4.85¢) (Trenton = 4.85¢)							5.737¢[13]		5.072¢	4.964¢
PILING, Steel sheet	3.30¢	3.30¢				3.30¢								3.75¢	3.756¢

CORROSION AND HEAT RESISTANT STEELS

In cents per pound, f.o.b. basing point

Basing Point	Chromium Nickel		Straight Chromium			
	No. 304	No. 302	No. 410	No. 430	No. 442	No. 446
Ingot, P'gh, Chi, Canton, Balt, Reading, Ft. Wayne, Phila.	Subject to negotiation			Subject to negotiation		
Blooms, P'gh, Chi, Canton, Phila, Reading, Ft. Wayne, Balt.	Subject to negotiation			Subject to negotiation		
Slabs, P'gh, Chi, Canton, Balt, Phila, Reading	Subject to negotiation			Subject to negotiation		
Billets, P'gh, Chi, Canton, Watervliet, Syracuse, Balt, Beth.	Subject to negotiation			Subject to negotiation		
Billets, forging, P'gh, Chi, Canton, Dunkirk, Balt, Phila, Reading, Water, Syracuse, Ft. Wayne, Titusville, Beth, Brackenridge	23.00	22.50	17.50	17.50	21.00	25.50
Bars, h-r, P'gh, Chi, Canton, Dunkirk, Watervliet, Syracuse, Balt, Phila, Reading, Ft. Wayne, Titusville, Beth, Brackenridge	27.50	26.00	20.50	21.00	24.50	30.00
Bars, c-f, P'gh, Chi, Cleve, Canton, Dunkirk, Syracuse, Balt, Phila, Reading, Ft. Wayne, Watervliet, Beth, Brackenridge	27.50	26.00	20.50	21.00	24.50	30.00
Plates, P'gh, Middletown, Canton, Brackenridge, Balt, Coatesville	31.50	29.50	23.50	24.00	28.00	33.00
Shapes, structural, P'gh, Chi, Brackenridge	27.50	26.00	20.50	21.00	24.50	30.00
Sheets, P'gh, Chi, Middletown, Canton, Balt, Brackenridge	39.00	37.00	29.00	31.50	35.50	39.50
Strip, h-r, P'gh, Chi, Reading, Canton, Youngstown	25.50	23.50	18.50	19.00	26.00	38.00
Strip, c-r, P'gh, Cleve, Jersey City, Reading, Canton, Youngstown, Balt, W. Leechburg	32.50	30.50	24.00	24.50	35.00	56.50
Wire, c-d, Cleve, Dunkirk, Syracuse, Balt, Reading, Canton, P'gh, Newark, N. J., Phila, Ft. Wayne, Brackenridge	27.50	26.00	20.50	21.00	24.50	30.00
Wire, flat, c-r, Cleve, Balt, Reading, Dunkirk, Canton, W. Leechburg	32.46	30.30	23.80	24.34	34.82	56.26
Rod, h-r, Syracuse	27.05	25.97	20.02	20.56	24.34	28.75
Tubing, seamless, P'gh, Chi, Canton, Brackenridge, Milwaukee	72.09	72.09	.....	68.49	.....	.....

TOOL STEEL

*(F.o.b. Pittsburgh, Bethlehem, Syracuse, Dunkirk. *Also Canton, Ohio)*

W	Cr	V	Mo	Co	Base per lb
18	4	1	—	—	82¢
18	4	1	—	5	$1.29
18	4	2	—	—	93¢
1.5	4	1.5	8	—	59¢
6	4	2	6	—	63¢

High-carbon-chromium* ..... 47¢
Oil hardening manganese* ..... 26¢
Special carbon* ..... 24¢
Extra carbon* ..... 20¢
Regular carbon* ..... 17¢

Warehouse prices on and east of Mississippi are 2¢ per lb higher; west of Mississippi, 4¢ higher.

ELECTRICAL SHEETS

Base, all grades f.o.b. Pittsburgh

	Per lb
Armature	4.80¢ to 5.05¢
Electrical	5.30¢ to 5.55¢
Motor	6.05¢ to 6.30¢
Dynamo	6.75¢ to 7.50¢
Transformer 72	7.25¢ to 8.25¢
Transformer 65	7.95¢ to 9.20¢
Transformer 58	8.65¢ to 9.90¢
Transformer 52	9.45¢ to 9.70¢

F.o.b. Chicago and Gary: armature through motor only. F.o.b. Granite City add to lower quotation 0.45¢ for armature through & 72, and 0.35¢ for balance.

RAILS, TRACK SUPPLIES

(F.o.b. mill)

Standard rails, heavier than 60 lb
No. 1 O.H., per 100 lb $2.75
Angle splice bars, 100 lb 3.85
(F.o.b. basing points) per 100 lb
Light rails (from billets) $3.10

	Base per lb
Cut spikes	4.85¢
Screw spikes	6.90¢
Tie plate, steel	3.65¢
Tie plates, Pittsburg, Calif.	3.80¢
Track bolts	7.00¢
Track bolts, heat treated, to railroads	7.25¢

Basing points, light rails, Pittsburgh, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, St. Louis, Kansas City, Minnequa, Colo.; Birmingham; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa.; Richmond.

ROOFING TERNEPLATE

(F.o.b. Pittsburgh, 112 sheets)

	20x14 in.	20x28 in.
8-lb coating I.C.	$7.05	$14.10

CLAD STEEL

Base prices, cents per pound

Stainless-clad	Plate	Sheet
No. 304, 20 pct, f.o.b. Pittsburgh, Washington, Coatesville, Pa.	*24.00	*22.00
Nickel-clad 10 pct, f.o.b. Coatesville, Pa.	21.50	.....
Inconel-clad 10 pct, f.o.b. Coatesville	30.00	.....
Monel-clad 10 pct, f.o.b. Coatesville	24.00	.....
Aluminized steel Hot dip, 20 gage, f.o.b. Pittsburgh	.....	9.00

* Includes annealing and pickling, or sandblasting.

MERCHANT WIRE PRODUCTS

To the dealer, f.o.b. Pittsburgh, Chicago, Birmingham

	Base Column	San Francisco
Standard & coated nails*	94	115
Galvanized nails*	94	115
Woven wire fence†	100	123
Fence posts, carloads††	105	...
Single loop bale ties	99	123
Galvanized barbed wire**	113	133
Twisted barbless wire	113	...

* Also Duluth; Worcester, 6 columns higher. † 15½ gage and heavier. ** On 80-rod spools, in carloads. †† Pittsburgh, Duluth only.

	Base per 100 lb	San Francisco
Annealed fence wire ‡	$4.20	$5.21
Annealed, galv. fencing ‡	4.65	5.66
Cut nails, carloads ‡‡	6.30	...

‡ Add 10¢ at Worcester. ‡‡ Pittsburgh only, less 20¢ to jobbers.

HIGH STRENGTH, LOW ALLOY STEELS

base prices, cents per pound

Steel	Alde-cor	Corten	Double Strength No. 1	Dyn-alloy	HI Steel	Mayari R	Otis-coloy	Yoloy	NAX High Tensile
Producer	Republic	Carnegie-Illinois, Republic	Republic	Alan Wood	Inland	Bethlehem	Jones & Laughlin	Youngstown Sheet & Tube	Great Lakes Steel
Plates	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55	4.55
Sheets									
Hot-rolled	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
Cold-rolled	5.30	5.30	5.30	..	.30	5.30	5.30	5.30	5.30
Galvanized		6.00	....	....	....	6.00	....	....	....
Strip									
Hot-rolled	4.30	4.30	4.30	...	4.30	4.30	4.30	4.30	4.30
Cold-rolled	....	....	5.30	....	....	5.30	5.30	5.30	5.30†
Shapes	....	4.30		....	4.30	4.30	4.30	4.30	....
Beams	....	4.30	....	....	....	4.30	....	....	....
Bars									
Hot-rolled	4.45	4.45	4.45	....	....	4.45	4.45	4.45	4.45
Bar shapes	....	4.45	....	....	4.45	4.45	4.45	4.45	....

† Pittsburgh, add 0.10¢ at Chicago and Gary.

PIPE AND TUBING

Base discounts, f.o.b. Pittsburgh and Lorain, steel buttweld and seamless. Others f.o.b. Pittsburgh only
Base price, $200.00 per net ton

Standard, threaded & coupled

Steel, buttweld	Black	Galv.
½-in.	47	29½
¾-in.	50	33½
1-in.	52½	36½
1¼-in.	53	37
1½-in.	53½	37½
2-in.	54	38
2½ and 3-in.	54½	38½
Wrought Iron, buttweld		
½-in.	+11	+35
¾-in.	+ 1½	+25
1 and 1¼-in.	4	+16½
1½-in.	9½	+13
2-in.	10	+12½
Steel, lapweld		
2-in.	44½	28
2½ and 3-in.	48½	32
3½ to 6-in.	50½	34
Steel, seamless		
2-in.	43½	27
2½ and 3-in.	46½	30
3½ to 6-in.	48½	32
Wrought Iron, lapweld		
2-in.	1½	+20
2½ to 3½-in.	4	+16
4-in.	8	+10½
4½ to 8-in.	6	+12

Extra Strong, plain ends

Steel, buttweld		
½-in.	46	30
¾-in.	50	34
1-in.	52	37
1¼-in.	52½	37½
1½-in.	53	38
2-in.	53½	38½
2½ and 3-in.	54	39
Wrought Iron, buttweld		
½-in.	+ 6½	+29
¾-in.	+ ½	+23
1 and 1¼ in.	4	+16½
2-in.	10	+12½
Steel, lapweld		
2-in.	43½	28
2½ and 3-in.	48½	33
3½ to 6-in.	52	36½
Steel, seamless		
2-in.	42½	27
2½ and 3-in.	46½	31
3½ and 6-in.	50	34½
Wrought Iron, lapweld		
2-in.	4½	+16½
2½ to 4-in.	13	+ 6
4½ to 6-in.	9	+10½

Basing discounts for standard pipe are for threads and couplings. For threads only, buttweld, lapweld and seamless pipe, one point higher discount (lower price) applies. For plain ends, buttweld, lapweld and seamless pipe 3-in. and smaller, three points higher discount (lower price) applies, while for lapweld and seamless 3½-in. and larger four points higher discount (lower price) applies. F.o.b. Gary prices are one point lower discount on all buttweld. On buttweld and lapweld steel pipe, jobbers are granted a discount of 5 pct. On l.c.l. shipments, prices are determined by adding 25 pct and 30 pct and the carload freight rate to the base card.

BOILER TUBES

Seamless steel and electric welded commercial boiler tubes and locomotive tubes, minimum wall. Net base prices per 100 ft, f.o.b. Pittsburgh in carload lots, cut length 4 to 24 ft, inclusive.

OD in in.	Gage BWG	Seamless Hot-Rolled	Seamless Cold-Drawn	Electric Weld Hot-Rolled	Electric Weld Cold-Drawn
2	13	$17.84	$20.99	$17.30	$20.36
2½	12	23.99	28.21	23.27	27.36
3	12	26.68	31.40	25.88	30.46
3½	11	33.35	39.26	32.35	38.08
4	10	41.40	48.70	40.16	47.24

CAST IRON WATER PIPE

Per net ton

6-in. to 24-in. del'd Chicago $91.12
6-in. to 24-in. del'd New York 89.18
6-in. to 24-in., Birmingham 79.50
6-in. and larger, f.o.b. cars, San Francisco, Los Angeles for all rail shipment; rail and water shipment less 105.90

Class "A" and gas pipe, $5 extra; 4-in. pipe is $5 a ton above 6-in.

BOLTS, NUTS, RIVETS, SET SCREWS

Consumer Prices

(Bolts and nuts f.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Base discount less case lots

Machine and Carriage Bolts

Percent Off List

½ in. & smaller x 6 in. & shorter .. 45
9/16 & ⅝ in. x 6 in. & shorter..... 46
¾ in. & larger x 6 in. & shorter.. ... 43
All diam, longer than 6 in. 41
Lag, all diam over 6 in. long 44
Lag, all diam x 6 in. & shorter..... 46
Plow bolts 54

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

½ in. and smaller 43
9/16 to 1 in. inclusive 42
1⅛ to 1½ in. inclusive 40
1⅝ in. and larger 35

On above bolts and nuts, excepting plow bolts, additional allowance of 15 pct for full container quantities. There is an additional 5 pct allowance for carload shipments.

Semifin. Hexagon Nuts	USS	SAE
7/16 in. and smaller	..	46
½ in. and smaller	44	..
½ in. through 1 in.	..	44
9/16 in. through 1 in. ...	43	..
1⅛ in. through 1½ in. ..	41	42
1⅝ in. and larger	35	..

In full case lots, 15 pct additional discount. For 200 lb or more, freight allowed up to 50¢ per 100 lb, based on Cleveland, Chicago, Pittsburgh.

Stove Bolts

Packages, nuts separate .....65 and 10
In bulk 75

On stove bolts freight allowed up to 65¢ per 100 lb based on Cleveland, Chicago, New York on lots of 200 lb or over.

Large Rivets *(½ in. and larger)*
Base per 100 lb

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham $5.65
F.o.b. Lebanon, Pa. 5.80

Small Rivets *(7/16 in. and smaller)*
Percent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham 55

Cap and Set Screws
(In packages) *Percent Off List*

Hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in., SAE 1020, bright 53
¾ to 1 in. x 6 in., SAE 1035, heat treated 44
Set screws, oval points 56
Milled studs 29
Flat head cap screws, listed sizes... 16
Fillister head cap, listed sizes 37

Freight allowed up to 65¢ per 100 lb based on Cleveland, Chicago or New York on lots of 200 lb or over.

FLUORSPAR

Metallurgical grade, f.o.b. producing plant.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$35.00
65% but less than 70%	34.00
60% but less than 65%.....	33.00
Less than 60%	32.00

LAKE SUPERIOR ORES

(51.50% Fe, Natural Content, Delivered Lower Lake Ports)

Per Gross Ton

Old range, bessemer $5.95
Old range, nonbessemer 5.80
Mesabi, bessemer 5.70
Mesabi, nonbessemer 5.55
High phosphorus 5.55

Prices quoted retroactive to Jan. 1, 1947.

METAL POWDER

Prices in cents per pound in ton lots, f.o.b. shipping point.

Brass, minus 100 mesh .....24¢ to 28½¢
Copper, electrolytic, 100 and 325 mesh .....30⅝¢ to 34⅝¢
Copper, reduced, 150 and 200 mesh .....30½¢ to 32¢
Iron, commercial, 100, 200, 325 mesh 96 + % Fe carlots..11.5¢ to 14.5¢
Swedish sponge iron, 100 mesh, c.i.f. N. Y., carlots, ocean bags..7.4¢ to 8.5¢
Domestic sponge iron, minus 48 mesh ..... 10¢
Iron, crushed, 200 mesh and finer, 90 + % Fe carload lots ..... 5¢
Iron, hydrogen reduced, 300 mesh and finer, 98 + % Fe, drum lots .....63¢ to 80¢
Iron, electrolytic, unannealed, 325 mesh and coarser, 99 + % Fe.. 44¢
Iron, electrolytic, annealed, 100 minus 200 mesh .....17¢ to 21¢
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe..... 39½¢
Iron carbonyl, 300 mesh and finer, 98-99.8 + % Fe .....90¢ to $1.75
Aluminum, 100, 200 mesh, carlots .....23¢ to 29¢
Antimony, 100 mesh ..... 44¢
Cadmium, 100 mesh $2.00
Chromium, 100 mesh and finer.. $1.025
Lead, 100, 200 & 300 mesh 20½¢ to 25½¢
Manganese, minus 325 mesh and coarser ..... 59¢
Nickel, 100 mesh ..... 51½¢
Silicon, 100 mesh ..... 29¢
Solder powder, 100 mesh..8½¢ plus metal
Stainless steel, 302, minus 100 mesh 75¢
Tin, 100 mesh ..... 90¢
Tungsten metal powder, 98%-99%, any quantity, per lb..... $2.90
Molybdenum powder, 99%, in 100-lb kegs, f.o.b. York, Pa., per lb.. $2.65
Under 100 lb $2.90

COKE

Furnace, beehive (f.o.b. oven)	Net Ton
Connellsville, Pa.	$12.00 to $13.00
Foundry, beehive (f.o.b. oven)	
Connellsville, Pa.	13.50 to 14.50
Foundry, Byproduct	
Chicago, del'd	$18.60
Chicago, f.o.b.	17.50
New England, del'd	20.40
Seaboard, Kearney, N. J., f.o.b..	17.85
Philadelphia, f.o.b.	17.75
Swedeland, Pa., f.o.b.	17.75
Buffalo, del'd	20.15
Ashland, Ohio, f.o.b.	15.50
Painesville, Ohio, f.o.b.	16.60
Erie, del'd	19.95
Cleveland, del'd	17.90
Cincinnati, del'd	18.59
St. Louis, del'd	18.03
Birmingham, del'd	15.76

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick *Carloads, Per 1000*

No. 1 Ohio $67.00
First quality, Pa., Md., Ky., Mo., Ohio 73.00
First quality, New Jersey 78.00
Sec. quality, Pa., Md.. Ky., Mo., Ohio 67.00
Sec. quality, New Jersey 70.00
No. 2 Ohio 59.00
Ground fire clay, net ton, bulk 10.50

Silica Brick

Pennsylvania and Birmingham $73.00
Chicago District and Alabama 82.00
Silica cement, net ton (Eastern) .. 12.50
East Chicago 13.50

Chrome Brick *Per Net Ton*

Standard chemically bonded, Balt., Plymouth Meeting, Chester $64.00

Magnesite Brick

Standard, Balt. and Chester $86.00
Chemically bonded, Baltimore 75.00

Grain Magnesite
std. ⅜-in. grains

Domestic, f.o.b. Balt. and Chester in bulk, fines removed $51.50
Domestic, f.o.b. Chewelah, Wash., in bulk with fines 27.00
in sacks with fines 31.50

Dead Burned Dolomite

F.o.b. producing points in Pennsylvania, West Virginia and Ohio, per net ton, bulk. Midwest, add 10¢; Missouri Valley, add 20¢..$11.05

WAREHOUSE PRICES

Base prices, delivered metropolitan areas, per 100 lb.

CITIES	SHEETS			STRIP		PLATES	SHAPES	BARS		ALLOY BARS			
	Hot-Rolled	Cold-Rolled (15 gage)	Galvanized (10 gage)	Hot-Rolled	Cold-Rolled		Standard Structural	Hot-Rolled	Cold-Finished	Hot-Rolled, A 4615 As-rolled	Hot-Rolled, A 4140-50 Ann.	Cold-Drawn, A 4615 As-rolled	Cold-Drawn, A 4140-50 Ann.
Philadelphia	$4.51	$5.78	$5.91	$4.83	$5.73	$4.86	$4.57	$4.88	$5.58	$8.52	$8.67	$10.13	$10.28
New York	4.76	5.78[1]	6.16	5.09	6.07	5.11	4.80	5.08	5.63	8.58	8.73	10.18	10.33
Boston	4.83	5.69	6.23[12]	5.61	6.87	5.18	4.91	5.04	5.69	8.20	8.35	9.50	9.65
Baltimore	4.33	....	5.73	4.81	....	4.78	4.73	4.86	5.56	....	....	....	....
Norfolk	4.90	....	....	5.30	....	5.15	5.15	5.20	6.00	....	....	....	....
Chicago	4.25	5.10	5.65	4.35	5.45	4.60	4.40	4.40	5.10	8.20	8.35	9.50	9.65
Milwaukee	4.458	5.308	5.858	5.058	5.658	4.808	4.608	4.608	5.395	8.495	8.795	9.945	10.095
Cleveland	4.25	5.10[1]	5.81	4.55	....	4.60†	4.68	4.40	5.10	8.51	8.66	9.50	9.65
Buffalo	4.25	5.10	6.05	5.25	5.70[5]	5.00	4.40‡	4.40‡	5.10	8.20	8.35	9.50	9.65
Detroit	4.10	5.26	6.07	4.77	5.67	4.92†	4.82	4.56–4.82	5.26	8.82	8.97	10.09	10.24
Cincinnati	4.55	5.21	5.76	4.79	5.74	4.99	4.84	4.79	5.49	8.73	8.88	10.04	10.19
St. Louis	4.61	5.46	6.07	4.71	5.87	4.96	4.76	4.76	5.52	8.77	8.92	10.07	10.22
Pittsburgh	4.25	5.10[1]	5.65	4.35	....	4.60	4.40	4.40	5.10	8.20	8.37	9.50	9.65
St. Paul	4.68	5.53	6.08	4.78	....	5.03	4.83	4.83	6.00	....	....	....	....
Omaha	5.262	....	6.712	5.362	....	5.612	5.412	5.412	6.112	....	....	....	....
Indianapolis	4.59	5.36	5.91	4.69	5.79	4.94	....	4.74	5.44	....	....	....	....
Birmingham	4.45[11]	....	5.80	4.45[11]	....	4.65[11]	4.40[11]	4.40[11]	6.13	....	....	....	....
Memphis	4.88[11]	5.94[1]	6.43	5.08[11]	....	5.23[11]	5.03[11]	5.03[11]	5.94	....	....	....	....
New Orleans	*5.05[11]	6.39[1]	....	5.25[11]	....	5.40[11]	*5.10[11]	*5.20[11]	6.39[6]	....	....	....	....
Houston	5.75[9]	....	7.36	6.00[9]	....	5.85[9]	5.85[9]	5.35[17]	7.00	9.40	9.25	10.40	10.55
Los Angeles	5.75	7.35[1]	7.40	6.05	8.70[5]	5.55	5.35	5.50	7.35[14]	9.70[15]	9.55[10]	11.15[15]	11.30[15]
San Francisco	5.40[8]	6.65	7.05	5.75[8]	8.70	5.50	5.20	5.05	7.50	9.70[15]	9.55[15]	11.15[15]	11.30[15]
Seattle	5.45[4]	7.25[2]	6.85	5.60[4]	....	5.60[4]	5.25[4]	5.45[4]	7.45[14]	....	8.95[16]	....	11.30[16]
Portland	5.30[4]	7.10[2]	6.70	5.60[4]	....	5.45[4]	5.25[4]	5.55[4]	7.45[14]	....	....	....	....
Salt Lake City	6.40	....	7.85	6.70	....	6.20	6.35	6.55	7.55	....	....	....	....

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT-ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD-ROLLED: Sheets, 400 to 1999 lb; strip, extras on all quantities; bars 1000 lb and over.

ALLOY BARS: 1000 to 1999 lb.

GALVANIZED SHEETS: 450 to 1499 lb.

EXCEPTIONS: (1) 400 to 1499 lb; (2) 450 to 1499 lb; (3) 300 to 4999 lb; (4) 300 to 9999 lb; (5) 2000 lb and over; (6) 1000 lb and over; (7) 400 to 14,999 lb; (8) 400 lb and over; (9) 500 to 1999 lb; (10) 500 to 999 lb; (11) 400 to 3999 lb; (12) 450 to 3749 lb; (13) 400 to 1999 lb; (14) 1500 lb and over; (15) 1000 to 4999 lb; (16) 4000 lb and over; (17) up to 1999 lb.

* Add 46¢ for sizes not rolled in Birmingham

† Up to ¾ in. thick and 90 in. wide.

‡ Add 40¢ for sizes not rolled at Buffalo.

PIG IRON PRICES

Dollars per gross ton. Delivered prices represent minimums. Delivered prices do not include 3 pct tax on freight.

BASING POINT* PRICES

Basing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	40.00	40.50	41.00	41.50	....
Birmingham	38.88	38.38-39.38	....	....	....
Buffalo	40.00-44.00*	40.00-44.50*	40.50-45.00*	....	....
Chicago	38.50	39.00	39.50	40.00	....
Cleveland	38.50-39.75*	39.00-40.25*	39.50-40.75*	....	....
Duluth	39.00	39.50	40.00	40.50	....
Erie	38.50	39.00	39.50	40.00	....
Everett	....	45.00	45.50	....	....
Granite City	39.50	40.00	40.50	....	....
Neville Island	39.00	39.50	39.50	40.00	....
Provo	39.00	39.50	....	....	....
Sharpsville	39.00	39.50	39.50	40.00	....
Steelton	40.00	....	....	....	46.00
Struthers, Ohio	39.50	....	....	....	....
Swedeland	45.00	45.50	46.00	46.50	....
Toledo	38.50	39.00	39.50	40.00	....
Troy, N. Y.	....	....	....	....	46.00
Youngstown	39.00	39.50	39.50	40.00	....

DELIVERED PRICES† (BASE GRADES)

Consuming Point	Basing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Boston	Everett	$0.50 Arb.	....	45.50	46.00	....	....
Boston	Steelton	5.78	45.78	....	....	....	51.78
Brooklyn	Bethlehem	3.60	43.60	44.10	44.60	45.10	....
Cincinnati	Birmingham	5.85	44.73	42.23-45.23	....	....	....
Jersey City	Bethlehem	2.21	42.21	42.71	43.21	43.71	....
Los Angeles	Provo	7.13	46.13	46.63	....	....	....
Mansfield	Cleveland-Toledo	2.56	41.06-42.31*	41.56-42.81*	42.06-43.31*	42.56	....
Philadelphia	Bethlehem	2.00	42.00	42.50	43.00	43.50	....
Philadelphia	Swedeland	1.21	46.21	46.71	47.21	47.71	....
Philadelphia	Steelton	2.59	42.59	....	....	....	48.59
San Francisco	Provo	7.13	46.13	46.63	....	....	....
Seattle	Provo	7.13	46.13	46.63	....	....	....
St. Louis	Granite City	0.75 Arb.	40.25	40.75	41.25	....	....

* Republic Steel Corp. price. Basis: Average price of No. 1 hvy. mlt. steel scrap at Cleveland or Buffalo respectively as shown in last week's issue of THE IRON AGE. Price is effective until next Sunday midnight.

Basing point prices are subject to switching charges; silicon differential (not to exceed 50¢ per ton for each 0.25 pct silicon content in excess of base grade which is 1.75 to 2.25 pct); phosphorus differentials, a reduction of 38¢ per ton for phosphorus content of 0.70 pct and over; manganese differentials, a charge not to exceed 50¢ per ton for each 0.50 pct manganese content in excess of 1.00 pct. $2 per ton extra may be charged for 0.5 to 0.75 pct nickel content and $1 per ton extra for each additional 0.25 pct nickel.

Silvery iron (blast furnace) silicon 6.00 to 6.50 pct, C/L per g.t., f.o.b. Jackson, Ohio—$49.50; f.o.b. Buffalo—$50.75. Add $1.25 per ton for each additional 0.50 pct Si, up to 12 pct. Add 50¢ per ton for each 0.50 pct Mn over 1.00 pct. Add $1.00 per ton for 0.75 pct or more P. Bessemer ferrosilicon prices are $1.00 per ton above silvery iron prices of comparable analysis.

Charcoal pig iron base price for low phosphorus $55.00 per gross ton, f.o.b. Lyle, Tenn. Delivered Chicago, $62.46. High phosphorus charcoal pig iron is not being produced.

Ferromanganese

78-82% Mn, Maximum contract base price, gross ton, lump size, f.o.b. Baltimore, Philadelphia, New York, Birmingham, Rockwood, Tenn.

Carload lots (bulk)	$145
Less ton lots (packed)	189.00
Delivered Pittsburgh	151.00

$1.80 for each 1% above 82% Mn; penalty, $1.80 for each 1% below 78%.

Briquets—Cents per pound of briquet, freight allowed, 66% contained Mn.

	Eastern	Central	Western
Carload, bulk	8.70	8.95	9.50
Ton lots	10.30	10.90	12.80
Less ton lots	11.20	11.80	13.70

Spiegeleisen

Contract prices, gross ton, lump, f.o.b. Palmerton, Pa

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Carloads	$46.00	$47.00
F.o.b. Pittsburgh	50.00	51.00

Manganese Metal

Contract basis, 2 in. x down, cents per pound of metal, f.o.b. shipping point, freight allowed, eastern zone.

96% min. mn, 0.2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	32
L.c.l. lots	34

Electrolytic Manganese

F.o.b. Knoxville, Tenn., freight allowed east of Mississippi, cents per pound.

Carloads	32
Ton lots	34
Less ton lots	36

Low-Carbon Ferromanganese

Contract price, cents per pound Mn contained, lump size, f.o.b. shipping point, freight allowed, eastern zone.

	Carloads	Ton	Less
0.07% max. C, 0.06% P, 90% Mn.	23.00	24.85	26.05
0.10% max. C.	22.50	24.35	25.55
0.15% max. C.	22.00	23.85	25.05
0.30% max. C.	21.50	23.35	24.55
0.50% max. C.	21.00	22.85	24.05
0.75% max. C, 7.00% max. Si	18.00	19.85	21.05

Silicomanganese

Contract basis, lump size, cents per pound of metal, f.o.b. shipping point, freight allowed, 65-70% Mn, 17-20% Si, 1.5% max. C.

Carload bulk	7.80
Ton lots	9.45
Briquet, contract basis, cariots, bulk freight allowed, per lb of briquet	8.75
Ton lots	10.35
Less ton lots	11.25

Silvery Iron (electric furnace)

Si 14.01 to 14.50 pct, f.o.b. Keokuk, Iowa, openhearth $78.00, foundry, $79.00; $78.75 f.o.b. Niagara Falls; $77.50 f.o.b. Jackson, Ohio. Electric furnace silvery iron is not being produced at Jackson. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 per ton for each 0.50 pct Mn over 1 pct.

Silicon Metal

Contract price, cents per pound contained Si, lump size, f.o.b. shipping point, freight allowed, for ton lots packed.

	Eastern	Central	Western
96% Si, 2% Fe.	16.90	17.50	18.10
97% Si, 1% Fe.	17.30	17.90	18.50

Silicon Briquets

Contract price, cents per pound of briquet, bulk, f.o.b. shipping point, freight allowed to destination, 40% Si, 1 lb Si briquets.

	Eastern	Central	Western
Carload, bulk	5.25	5.50	5.70
Ton lots	6.85	7.45	7.75
Less ton lots	7.75	8.35	8.65

Electric Ferrosilicon

Contract price, cents per pound contained Si, lump size in carloads, f.o.b. shipping point, freight allowed.

	Eastern	Central	Western
25% Si	15.50	....	....
50% Si	9.30	9.80	10.00
75% Si	11.80	12.10	12.85
85% Si	13.30	13.60	14.35
90% Si	15.00	15.30	16.00

Ferrochrome (65-72% Cr, 2% max. Si)

Contract prices, cents per pound, contained Cr, lump size in carloads, f.o.b. shipping point, freight allowed.

	Eastern	Central	Western
0.06% C	26.50	26.90	27.00
0.10% C	26.00	26.40	26.50
0.15% C	25.50	25.90	26.00
0.20% C	25.25	25.65	25.75
0.50% C	25.00	25.40	25.50
1.00% C	24.50	24.90	24.75
2.00% C	24.25	24.65	24.75
65-69% Cr, 4-9% C	18.60	19.00	19.15
62-66% Cr 4-6% C, 6-9% Si.	18.60	19.00	19.15

Briquets — Contract price, cents per pound of briquet, f.o.b. shipping point, freight allowed, 60% chromium.

	Eastern	Central	Western
Carload, bulk	12.50	12.75	12.85
Ton lots	14.00	14.90	15.50
Less ton lots	14.90	15.80	16.40

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 2¢ per lb to regular low carbon ferrochrome price schedule. Add 2¢ for each additional 0.25% N.

S. M. Ferrochrome

Contract price, cents per pound chromium contained, lump size, f.o.b. shipping point, freight allowed.

High carbon type: 60-65% Cr, 4-6% Si, 4-6% Mn, 4-6% C.

	Eastern	Central	Western
Carload	19.70	20.10	20.25
Ton lots	21.85	23.15	23.95
Less ton lots	23.35	24.65	25.45

Low carbon type: 62-66% Cr, 4-6% Si, 4-6% mn, 1.25% max. C.

	Eastern	Central	Western
Carload	25.00	25.40	25.50
Ton lots	27.30	27.95	29.15
Less ton lots	29.10	29.75	30.95

Chromium Metal

Contract prices, cents per lb, chromium contained carload packed, f.o.b. shipping point freight allowed, 97% min. Cr, 1% max. Fe.

	Eastern	Central	Western
0.20% max. C.	97.00	98.50	99.75
0.50% max. C.	93.00	94.50	95.75
9.00% min. C.	91.50	93.00	94.25

Calcium—Silicon

Contract price per lb of alloy, lump, f.o.b. shipping point, freight allowed.

30-35% Ca, 60-65% Si, 3.00% max. Fe or 28-32% Ca, 60-65% Si, 6.00% max. Fe.

	Eastern	Central	Western
Carloads	16.25	16.75	18.80
Ton lots	19.35	20.10	22.25
Less ton lots	20.85	21.60	23.75

Calcium—Manganese—Silicon

Contract prices, cents per lb of alloy, lump, f.o.b. shipping point, freight allowed.

16-20% Ca, 14-18% Mn, 53-59% Si.

	Eastern	Central	Western
Carloads	17.50	18.00	20.05
Ton lots	19.80	20.65	22.40
Less ton lots	20.80	21.65	23.40

Calcium Metal

Eastern zone contract prices, cents per pound of metal, f.o.b. shipping point, freight allowed. Add 1.5¢ for central zone; 3.5¢ for western zone.

	Cast Turnings	Distilled
Ton lots	$1.85	$2.70 $3.40
Less ton lots	2.20	3.05 4.20

CMSZ

Contract price, cents per pound of alloy, f.o.b. shipping point, freight allowed.

Alloy 4: 45-49% Cr, 4-6% Mn, 18-21% Si, 1.25-1.75% Zr, 3.00-4.5% C.

Alloy 5: 50-56% Cr, 4-6% Mn, 13.50-16.00% Si, 0.75 to 1.25% Zr, 3.50-500% C.

	Eastern	Central	Western
Ton lots	18.00	19.10	21.05
Less ton lots	19.25	20.35	22.30

SMZ

Contract price, cents per pound of alloy, f.o.b. shipping point, freight allowed. 60-65% Si, 5-7% Mn, 5-7% Zr, 20% Fe, ½ in. x 12 mesh.

	Eastern	Central	Western
Ton lots	15.75	16.85	18.80
Less ton lots	17.00	18.10	20.05

Other Ferroalloys

Ferrotungsten, standard, lump or ¼ x down, packed, f.o.b. plant Niagara Falls, Washington, Pa., York, Pa., per pound contained W, 5 ton lots, freight allowed... $2.25

Ferrovanadium, 35-55%, contract basis, f.o.b. plant, freight allowances, per pound contained V.

Openhearth	$2.90
Crucible	3.00
High speed steel (Primos)	3.10

Vanadium pentoxide, 88-92% V_2O_5 contract basis, per pound contained V_2 ... $1.30

Ferrocolumbium, 50-60%, contract basis, f.o.b. plant, freight allowed, per pound contained Cb

Ton lots	$2.50
Less ton lots	$2.55

Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., per pound contained Mo. ... 95¢

Calcium molybdate, 40-45%, f.o.b. Langeloth, Washington, Pa., per pound contained Mo. ... 80¢

Molybdenum oxide briquets, 48-52% Mo, f.o.b. Langeloth, Pa., per pound contained Mo. ... 80¢

Molybdenum oxide in cans, f.o.b. Langeloth and Washington, Pa., per pound contained Mo. ... 80¢

Ferrotitanium, 40-45%, 0.10% C max., f.o.b. Niagara Falls, N. Y., ton lots, per pound contained Ti ... $1.22

Less ton lots ... $1.25

Ferrotitanium, 20-25%, 0.10% C max., ton lots, per pound contained Ti ... $1.35

Less ton lots ... $1.40

High carbon ferrotitanium, 15-20%, 6-8% C, contract basis, f.o.b. Niagara Falls, freight allowed, carloads, per net ton ... $142.50

Ferrophosphorus, electrolytic, 23-26%, carlots, f.o.b. (Siglo) Tenn., $3 unitage per gross ton $65.00

Zirconium, 35-40%, contract basis, f.o.b. plant, freight allowed, per pound of alloy.

Carload lots	18.40¢

Zirconium, 12-15%, contract basis, lump, f.o.b. plant, freight allowed, per pound of alloy

Carload, bulk	6.00¢

Alsifer, 20% Al, 40% Si, 40% Fe, contract basis, f.o.b. Suspension Bridge, N. Y.

Carload	6.90¢
Ton lots	7.40¢

Simanal, 20% Si, 20% Mn, 20% Al, contract basis, f.o.b. Philo, Ohio, freight allowed, per pound

Car lots	9.50¢
Ton lots	10.25¢

Boron Agents

Contract prices per pound of alloy, f.o.b. shipping point, freight allowed

Ferroboron, 17.50% min. B, 1.50% max Si, 0.50% max. Al, 0.50% max. C.

Eastern	Central	Western
$1.20	$1.23	$1.21

Manganese—Boron 75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C.

Ton lots	$1.89	$1.903	$1.935
Less ton lots	2.01	2.023	2.044

Nickel—Boron 15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni.

Less ton lots	$1.80	$1.8125	$1.8445

Silcaz, contract basis, f.o.b. plant freight allowed, per pound.

Carload lots	39.00¢

Grainal, f.o.b. Bridgeville, Pa., freight allowed, 50 lb and over.

No. 1	93¢
No. 6	63¢
No. 79	45¢

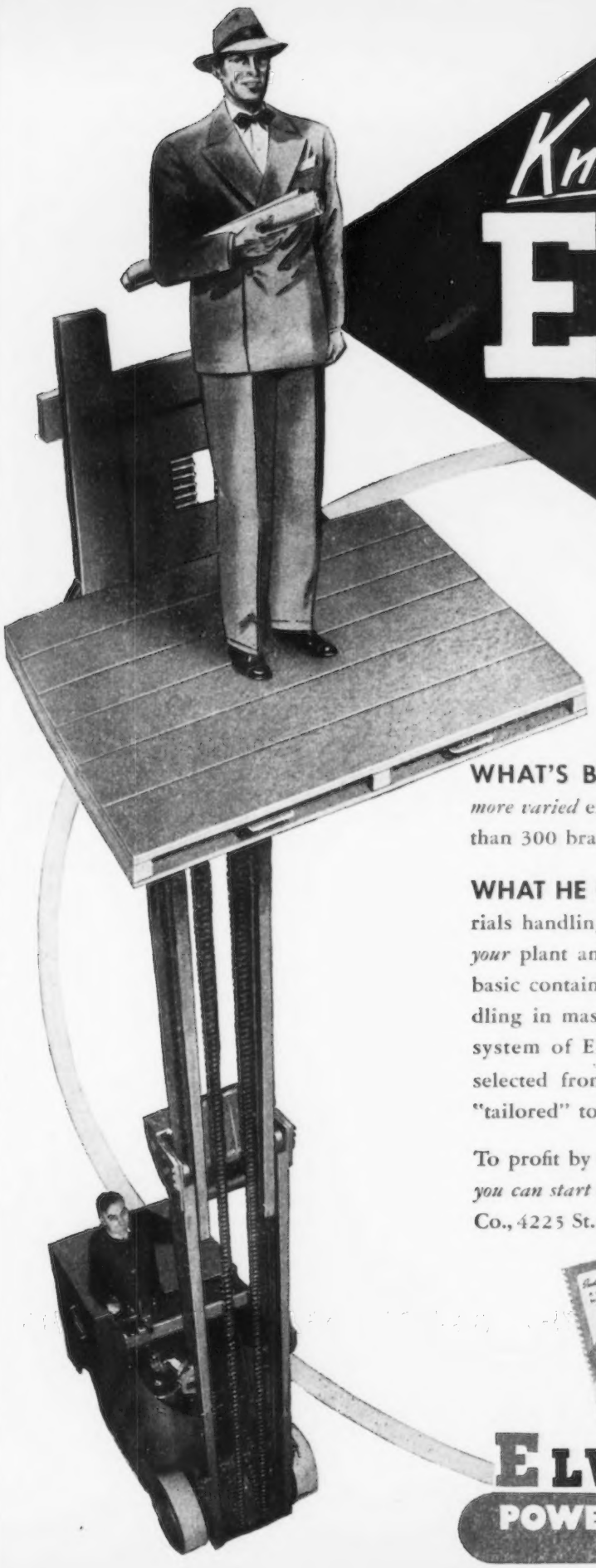
Bortram, f.o.b. Niagara Falls

Ton lots, per pound	45¢
Less ton lots, per pound	50¢

Carbortam, f.o.b., Suspension Bridge, N. Y., freight allowed, Ti 15-17%, B 0.90-1.15%, Si 2.5-3.0%, Al 1.0-2.0%.

Ton lots, per pound	8.0¢

Borosil, f.o.b. Philo, Ohio, freight allowed, B 3%-4%, Si 40%-45%, per lb contained B ... $6.25



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Established 1893

MACHINE TOOLS

. . . News and Market Activities

New Firm Orders Increasing, Outlook for March Encouraging

• • • **Reliable sources** in the trade report a slight increase in new firm orders during the past week, making the outlook for the rest of March more encouraging.

Business is fairly general in some sectors, and if the present pickup in new orders carries through the next two weeks, March will probably go into the records as a better month than February.

Reports that machine tool builders are due for $115 million in foreign orders under the Marshall Plan are raising speculation in trade circles as to distribution. Present indications are that France will get about $40 million; Austria about $10 million; and Holland about $5 million. Belgium, Sweden and other MP countries will come in for varying amounts. Austria's $10 million requirement may be changed as a result of a recent gift of a lot of equipment, some American-made but not lend-lease, from England.

For most machine tool builders, foreign business in 1947 was about normal. Outlook for 1948, however, without the MP, anticipates a 50 pct drop in foreign orders.

While manufacturers of special machine tools apparently are not looking far for business, producers of standard equipment have been experiencing difficulties in developing new orders. Many indicate that proposals are easy to obtain, but the trick comes in trying to convert these proposals into firm orders. Because all proposals mean considerable engineering expense to the machine tool manufacturer, unless an order follows there is no means of recovering this expense. At least one producer has indicated that he would like to see the industry adopt some method of charging prospective customers for this service.

Lack of new orders among standard equipment manufacturers has been laid partly to the door of WAA disposal of machine tools from surplus. Further, tax policies with respect to depreciation allowances on plant equipment have definitely hindered new equipment procurement.

Tool Builders Expecting $115 Million In Foreign Orders Under Marshall Plan

o o o

Meanwhile, Detroit tool and die shops are filled with work and there appears to be no noticeable slackening of interest in special tooling, particularly of the transfer type.

Negotiations for the purchase of a substantial amount of new equipment for the Dodge forge plant are reported to be at the closing stages and some contracts have already been awarded.

Reo is said to be writing orders for a substantial number of machines which are expected to be awarded this week.

Willingness of comparatively small Detroit shops to obligate themselves for equipment calling for payments over the next 12 months is an encouraging sign in today's market for machine tools, although few machine tool builders or distributors are willing to place much confidence in predictions for the third quarter.

Volume of inquiries on automatic transfer machinery remains very high in Chicago. The trade is convinced that this particular end of the business is going to be very good for the rest of the year. Large automotive companies, it is reported, used to figure that they could spend $3000 per man taken off the line in buying automatic machinery.

Recently one of the larger automotive companies has said they are willing at present to spend $7500 in automatic machinery if it will dispense with a single worker on any heavy volume production. Companies selling specialized machinery report that the terrific volume of inquiries has increased the time it takes them to get out proposals. One company in Chicago reported that the best they can do on proposals at the moment is 5 or 6 weeks.

Definite hesitation has been noticed in Chicago on the part of companies who were ready to place large commitments on machinery. Some of the larger programs have been cut in half over what was planned early in January. Machine tool trade in Chicago is proceeding with extreme caution in regard to the Tucker Corp. inquiries on machinery. They recall some of the difficulties that were encountered by some machine tool builders when Kaiser-Frazer was tooling up.

Railroad buying of lathes has been singularly heavy in the past month. Some of these railroad programs that are just being placed were anticipated last year but were postponed at that time.

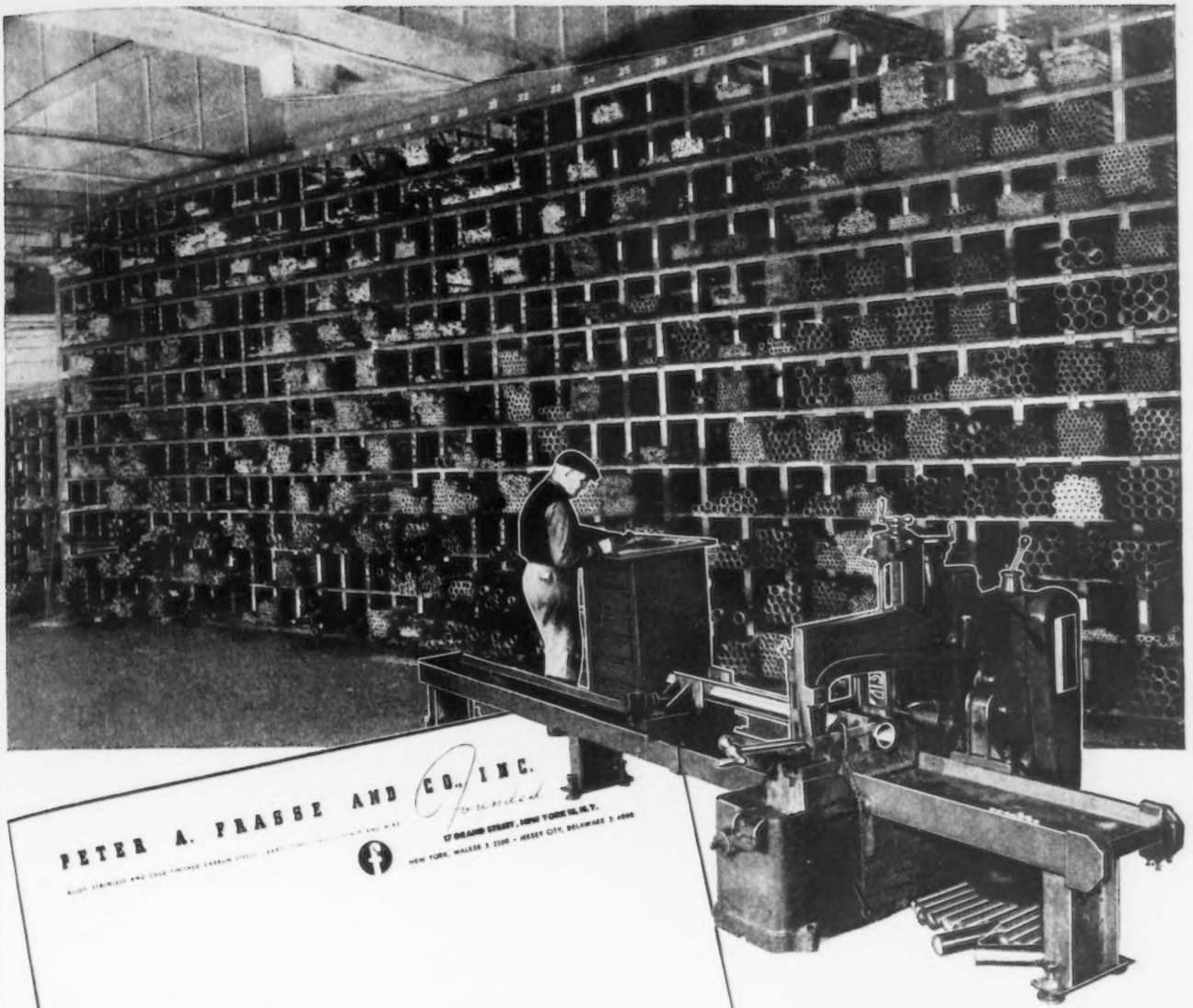
In the East, dealers surveying their February volume of orders find them not far below January levels but new inquiries have dropped severely. To some observers, this is a fairly good indication that dealer order volume in the next four months will be down. Most current orders are for special-purpose tools. There is practically no interest in the less specialized tools for toolroom use.

Dealers report that there was a general increase of 10 pct in the price of lathes last month. Although increases in other types of tools have not been forecast, dealers state that higher prices would make it much more difficult to move them.

AISE To Meet Apr. 26

Pittsburgh

• • • **The annual** spring conference sponsored by the rolling mill committee of the Assn. of Iron & Steel Engineers will be held in Buffalo Apr. 26 and 27. Headquarters will be at Hotel Statler.



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Armstrong-Blum Mfg. Co.
5700 Bloomingdale Avenue
Chicago 39, Illinois

Gentlemen:

We are very satisfied with the performance of the new 6A and 9A Marvel Heavy-Duty Automatic Hack Saw Machines recently installed in our Warehouses. Our decision to purchase these new Marvel saws was based on the satisfactory performance we have been receiving for the past 10 years from our original Marvel machines.

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Marvel saws and high-speed edge hack saw blades are giving satisfactory performance in all our warehouses, and your service has been most cooperative.

Very truly yours,

PETER A. FRASSE AND CO., INC.

W. E. Davis
Assistant Vice President

WED/amc

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You will get cut-off lengths in any quantity faster from the steel warehouses and stockrooms that are equipped with MARVEL 6A and 9A Automatic Hack Saws. Far faster, floor to floor, than any other hack saws, they save valuable machine hours by reducing cutting-off time to a fraction,—save other machining hours by producing accurately cut pieces of exact length.

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MARVEL *Metal Cutting* SAWS

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NONFERROUS METALS

. . . News and Market Activities

Market Sources See 90,000 Tons of Tin For 1948 Allocations

New York

• • • **The pessimistic statement** of the Combined Tin Committee when it announced interim allocations of 17,703 tons for the first half of the year and predicted that this tonnage would represent more than half of the tin which would be available during the period has been questioned by London market quarters. Last year's record of the Committee's estimates of production, covered by statements made at the time of allocation, conflicted repeatedly with subsequent allocations and with the news of production current at the time of the statements.

Estimates by informed sources place 1948 production at about 160,000 tons, 72,000 tons during the first half, 88,000 in the last half. The estimate is based on reasonable progress in rehabilitation and, barring any serious interruptions in production due to political or labor troubles, there should be no need for any controls over consumption after next Autumn at the latest, according to this opinion.

1948 Estimated Tin Production

	Long Tons
Malaya	44,000
Netherlands Indies	32,000
Siam	7,000
Burma	1,500
Australia	2,500
China	7,000
Nigeria	9,000
Belgian Congo	16,000
Other Africa	2,000
Bolivia	36,000
United Kingdom	600
Portugal, Spain	1,000
Indo China, Others	3,000
Total	161,600

World consumption, if unrestricted, is estimated to reach about 155,000 to 160,000 tons, plus any tonnages that might be reserved to Russia. Germany and other eastern European countries are permitted to acquire only a small portion of the tonnages consumed in prewar years. But this is balanced by higher requirements of other countries due to wartime industrial developments. This would include Canada, some South American countries, and Australia, which formerly had a limited tonnage for export.

The difference in tonnages between total production of tin and total allocations of the Combined Tin Committee is due to the fact that producing nations retain their own requirements before reporting their surplus for allocation. The output of the Longhorn smelter is offset against total U. S. requirements. Total 1947 allocations were 46,269 tons out of an estimated production of 114,000 tons. The balance of smelter production retained for internal consumption totals about 70,000 tons.

Tin Withheld From Allocations 1947

	Long Tons
United Kingdom	26,000
Holland	2,500
Belgium	2,500
United States	33,280
Australia	2,500
South Africa	1,000
Portugal, Spain	600
China	800
Argentina	500
Total	69,680

On the basis of these estimates, by deduction of an estimated 70,000 tons to be withheld from an estimated world production of 160,000 tons, London quarters predict that 90,000 tons of tin will be available for allocation during 1948, more than twice as much as allocated in 1947.

Copper

• • • **Demand for copper** continues at peak levels and producers are required to pare down tonnages asked for by most consumers. Producers opened up for April delivery last week. Export requirements are reported to be increasingly heavy. The export price of major producers is held at 21.50¢, although sales are reported as high as 22.00¢, delivery time ranging from the second quarter to the second half of the year. Wire mill and brass mill demand are continuing high.

●

Zinc

• • • **Zinc demand** continues at a high level in all grades. Brass mills reported having some difficulty in obtaining their requirements of Prime Western and High Grade. There is no indication of any immediate prospect for an increase in price, but further developments are contingent on price action in the Joplin ore market, unchanged last week. Slab zinc production during February declined by 4800 tons to 66,784 tons, as reported by the American Zinc Institute. The drop was due entirely to the shorter month, as the daily average held at 2303 tons. Domestic shipments during the month declined by 2000 tons to 62,503 tons, but export shipments dropped nearly 4000 tons to 5893 tons. Stock at the end of February was down to 53,473 tons, a decline of 1600 tons. Unfilled orders at the end of February rose to 72,224 tons, another sharp monthly increase in a trend which has been developing since November.

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Lead

• • • **Lead is the most** critically short nonferrous metal and consumers are upset over the continuation of the strike at the Monterrey refinery of American Smelting & Refining Co. Largely because of this development, producers delayed their openings for April, but expected to be in a position to allocate metal this week. The let-up in the requirements of the battery industry has not served to relieve the supply problem of consumers appreciably.

Nonferrous Metals Prices

Cents per pound

	Mar. 10	Mar. 11	Mar. 12	Mar. 13	Mar. 15	Mar. 16
Copper, electro, Conn.	21.50	21.50	21.50	21.50	21.50	21.50
Copper, Lake, Conn.	21.625	21.625	21.625	21.625	21.625	21.625
Tin, Straits, New York	94.00	94.00	94.00	94.00	94.00	94.00
Zinc, East St. Louis	12.00	12.00	12.00	12.00	12.00	12.00
Lead, St. Louis	14.80	14.80	14.80	14.80	14.80	14.80

Primary Metals

(Cents per lb. unless otherwise noted)

Aluminum, 99+%, f.o.b. shipping point, freight allowed	15.00
Aluminum pig, f.o.b. shipping point	14.00
Antimony, American, Laredo, Tex.	33.00
Beryllium copper, 3.75-4.25% Be dollars per lb contained Be	$20.50
Beryllium aluminum 5% Be, dollars per lb contained Be	$40.00
Cadmium, del'd	$1.75
Cobalt, 97-99% (per lb)	$1.65 to $1.72
Copper electro, Conn. Valley	21.50
Copper, lake, Conn. Valley	21.625
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$2.25
Iridium, dollars per troy oz.	$95 to $105
Lead, St. Louis	14.80
Lead, New York	15.00
Magnesium, 99.8+%, f.o.b. Freeport, Tex.	20.50
Magnesium, sticks, carlots	34.50
Mercury, dollars per 16-lb flask, f.o.b. New York	$77 to $79
Nickel, electro, f.o.b. New York	36.56
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per troy oz.	$72 to $75
Silver, New York, cents per oz.	74.625
Tin, Grade A, New York	94.00
Zinc, East St. Louis	12.00
Zinc, New York	12.61
Zirconium copper, 6 pct Zr, per lb contained Zr	$8.75

Remelted Metals

Brass Ingot

(Cents per lb, in carloads)

85-5-5-5 ingot	
No. 115	18.50-19.25
No. 120	18.00-18.75
No. 123	17.50-18.25
80-10-10 ingot	
No. 305	24.25
No. 315	21.75
88-10-2 ingot	
No. 210	30.00
No. 215	28.00
No. 245	21.25-22.75
Yellow ingot	
No. 405	14.50-16.00
Manganese bronze	
No. 421	18.00

Aluminum Ingot

(Cents per lb, lots of 30,000 lb)

95-5 aluminum-silicon alloys:	
0.30 copper, max.	17.50-17.75
0.60 copper, max.	17.25-17.50
Piston alloys (No. 122 type)	16.50-16.75
No. 12 alum. (No. 2 grade)	16.25-16.75
108 alloy	16.25-16.75
195 alloy	16.50-16.75
AXS-679	16.50-17.00
Steel deoxidizing aluminum, notch-bar, granulated or shot	
Grade 1—95 pct-95½ pct	16.50-17.00
Grade 2—92 pct-95 pct	16.00-16.50
Grade 3—90 pct-92 pct	15.75-16.00
Grade 4—85 pct-90 pct	15.25-15.50

Electroplating Supplies

Anodes

(Cents per lb, f.o.b. shipping point in 500 lb lots)

Copper, frt. allowed	
Cast, oval, 15 in. or longer	37⅝
Electrodeposited	32⅝
Rolled, oval, straight, delivered	33.09
Brass, 80-20, frt. allowed	
Cast, oval, 15 in. or longer	33⅜
Zinc, cast, 99.99	20.50
Nickel 99 pct plus, frt. allowed	
Cast	51
Rolled, depolarized	52
Silver 999 fine	
Rolled, 1000 oz lots per troy oz.	67¼

Chemicals

(Cents per lb, f.o.b. shipping point)

Copper cyanide, 100 lb drum	43.00
Copper sulfate, 99.5, crystals, bbls.	11.50
Nickel salts, single, 425 lb bbls. frt. allowed	14.50
Silver cyanide, 100 oz. lots, per oz.	54.00
Sodium cyanide, 96 pct domestic, 100 lb drums	15.00
Zinc cyanide, 100 lb drums	34.00
Zinc sulfate, 89 pct, granules, bbls, frt. allowed	7.75

Mill Products

Aluminum

(Base prices, cents per pound, base 30,000 lb., f.o.b. shipping point, freight allowed.)

Flat Sheet: 0.188 in., 2S, 3S, 24¢; 4S, 61S-O, 25.8¢; 52S, 27.7¢; 24S-O, 24S-OAL, 26.7¢; 75S-O, 75S-OAL, 32.7¢. **0.081 in.**; 2S, 3S, 25¢; 4S, 61S-O, 27.1¢; 52S, 29¢; 24S-O, 24S-OAL, 27.7¢; 75S-O, 75S-OAL, 34.3¢. **0.032 in.**; 2S, 3S, 26.4¢; 4S, 61S-O, 30.1¢; 52S, 32.6¢; 24S-O, 24S-OAL, 34.2¢; 75S-O, 75S-OAL, 43.1¢.

Plate: ¼ in. and heavier; 2S, 3S, 21.2¢; 4S-F, 23.2¢; 52S, 24.2¢; 61S-O, 23.8¢; 24S-F,24S-FAL, 24.2¢; 75S, 75S-AL, 30.5¢.

Extruded Solid Shapes: Shape factors **1 to 4;** 31¢ to 59¢; **11 to 13,** 31.9¢ to 69¢; **23 to 25,** 33.4c to 90¢; **35 to 37,** 40.8¢ to $1.25; **47 to 49,** 58.7¢ to $1.84.

Extruded Round Rod, Square, Hex, Octagonal Bar: ¼ in. and over, 27¢ to 38¢; ½ to ¾ in., 28¢ to 40.5¢; ⅝ to ½ in., 29c to 43c; ¼ to ⅜ in., 30¢ to 46.5¢; ⅞ to 7/8 in., 32.5¢ to 53.5¢; 9/64 to ⅜ in., 35.5¢ to 62¢.

Rolled Rod: 1.064 to 4.5 in., 2S, 3S, 30¢ to 26.5¢; Cold-finished rod, 0.375 to 3.5 in., 2S, 3S, 32¢ to 28¢.

Screw Machine Stock: Drawn, 1½ to 1⅛ in., 11S-T3, 34¢ to 45¢; cold-finished, ⅜ to 1½ in., 11S-T3, 33¢ to 31¢; rolled, 1⅞ to 3 in., 11S-T3, 31¢ to 28.5¢.

Drawn Wire: coiled, 0.051 to 0.374 in.; 2S, 33¢ to 24¢ 52S, 40.5c to 29c; 56S, 42.5¢ to 34.5¢; 17S-T4, 46¢ to 31¢; 61S-T4, 41c to 30.5c; 75S-T6, 66¢ to 46¢.

Magnesium

(Cents per lb, f.o.b. mill, freight allowed. Base quantity 30,000 lb.)

Sheet and Plate: Ma. FSa. ¼ in., 54¢-56¢; 0.188 in., 56¢-58¢; B & S gage 8, 58c-60c; 10, 59c-61c; 12, 63-65c; 14, 69c-74c; 16, 76c-81c; 18, 84c-89c 20, 96c-$1.01; 22, $1.22-$1.31; 24, $1.62-$1.75. Specification grade higher.

Round Rod: M. diam., in., ¼ to ⅝, 47¢; ½ to ¾, 45¢; 1¼ to 2½, 43.5¢; 3½ to 5, 42.5¢. Other alloys higher.

Square, Hexagonal Bar: M. size across flats, in., ½ to ¾, 52.5¢; ½ to ¾, 47.5¢; 1¼ to 2½, 45¢; 3½ to 5, 44¢. Other alloys higher.

Solid Shapes, Rectangles: M. form factors, 1 to 4, 46¢; 11 to 13, 49¢; 20 to 22, 51.5¢; 29 to 31, 59.5¢; 38 to 40, 75.5¢; 47 to 49, 98¢. Other alloys higher.

Round Tubing: M. wall thickness, outside diam, in., 0.049 to 0.057, ⅛ to ⅝, $1.21; ⅝ to ¾, $1.12; ⅝ to 7/8, 97¢; 0.058 to 0.064, 7/8 to 1½, 89¢; ½ to ⅝, 81¢; 0.065 to 0.082, ⅝ to ¾, 76¢; ¾ to 1, 72¢; 0.083 to 0.108, 1 to 2, 68¢; 0.165 to 0.219, 2 to 3, 59¢; 3 to 4, 57¢. Other alloys higher.

Nickel and Monel

(Cents per lb, f.o.b. mill)

	Nickel	Monel
Sheets, cold-rolled	54	43
No. 35 sheets		41
Strip, cold-rolled	60	44
Rod		
Hot-rolled	50	39
Cold-drawn	55	44
Angles, hot-rolled	50	39
Plates	52	41
Seamless tubes	83	71
Shot and blocks		31

Copper, Brass, Bronze

(Cents per pound, freight prepaid on 200 lb)

	Extruded Shapes	Rods	Sheets
Copper	33.53	....	33.68
Copper, hot-rolled	....	30.03	....
Copper, drawn	....	31.03	....
Low brass	34.36*	31.39	31.70
Yellow brass	32.92*	29.85	30.16
Red brass	34.89*	31.92	32.23
Naval brass	30.28	29.03	24.97
Leaded brass	28.64	24.69	....
Commercial bronze	35.68*	32.96	33.27
Manganese bronze	33.87	32.37	38.47
Phosphor bronze, 5 pct	53.95*	52.95	52.70
Muntz metal	29.80	28.55	32.99
Everdur, Herculoy, Olympic, etc.	37.24	37.50	38.56
Nickel silver, 10 pct.	41.80	42.68	40.54
5 pct	....	....	38.98
Architectural bronze	28.61	....	....

*Seamless tubing.

Scrap Metals

Brass Mill Scrap

(Cents per pound; add 1¢ per lb for shipments of 15,000 lb or more.)

	Heavy	Turnings
Copper	19⅛	18⅝
Yellow brass	15⅝	14⅜
Red brass	17½	16¾
Commercial bronze	17⅝	16⅞
Manganese bronze	15¼	14⅜
Leaded brass rod ends	15¾	....

Custom Smelters' Scrap

(Cents per pound, carload lots, delivered to refinery.)

No. 1 copper, wire	18.00
No. 2 copper, wire	17.00
Light copper	16.00
Refining brass	15.50*

*Dry copper content.

Ingot Makers' Scrap

(Cents per pound, carload lots, delivered to producer.)

No. 1 copper, wire	17.00
No. 2 copper wire	16.00
Light copper	15.00
No. 1 composition	14.00
No. 1 comp. turnings	13.75
Low brass	11.50
Brass pipe	11.00
Radiators	11.00
Heavy yellow brass	10.00
Aluminum	
Mixed old cast	9.75
Mixed old clips	9.75
Mixed turnings	9.00
Pots & pans	10.00
Low copper	10.50

Dealers' Scrap

(Dealers' buying prices, f.o.b. New York in cents per pound.)

Copper and Brass

No. 1 heavy copper and wire	16 —16½
No. 2 heavy copper and wire	15 —15½
Light copper	14 —14½
Auto radiators (unsweated)	9 — 9½
No. 1 composition	11½—12
No. 1 composition turnings	11 —11½
Clean red car boxes	9¼— 9¾
Cocks and faucets	9¼— 9½
Mixed heavy yellow brass	7 — 7½
Old rolled brass	7½— 8
Brass pipe	9 — 9¼
New soft brass clippings	11¼—11¾
Brass rod ends	9¾—10¼
No. 1 brass rod turnings	9¼— 9¾

Aluminum

Alum. pistons with struts	4½— 5
Aluminum crankcases	6½— 7
2S aluminum clippings	9 — 9½
Old sheet & utensils	7 — 7½
Dry borings and turnings	2½— 3
Misc. cast aluminum	6½— 7
Dural clips (24S)	6 — 6½

Zinc

New zinc clippings	7 — 7½
Old zinc	5 — 5½
Zinc routings	3 — 3½
Old die cast scrap	3 — 3½

Nickel and Monel

Pure nickel clippings	16 —17
Clean nickel turnings	12½—13
Nickel anodes	16 —17
Nickel rod ends	16 —17
New Monel clippings	12 —13
Clean Monel turnings	7 — 8
Old sheet Monel	10 —10½
Old Monel castings	7½— 8
Inconel clippings	8 — 8½
Nickel silver clippings, mixed	8 — 8½
Nickel silver turnings, mixed	6½— 7

Lead

Soft scrap lead	12½—13
Battery plates (dry)	7 — 7½

Magnesium Alloys

Segregated solids	7½— 8
Castings	4½— 5½

Miscellaneous

Block tin	75 —77
No. 1 pewter	60 —62
No. 1 auto babbitt	45 —47
Mixed common babbitt	13½—14
Solder joints	16½—17
Siphon tops	45 —47
Small foundry type	16 —16½
Monotype	15 —15½
Lino. and stereotype	14 —14½
Electrotype	11½—12
New type shell cuttings	14½—15
Clean hand picked type shells	6½— 7
Linо and stereo dross	6½— 7
Electro dross	4½— 5

existing in the melt should constantly diminish, because some of the water vapor formed is constantly pumped away. When the reaction has progressed to a reasonable length of time, an improvement in final metal gas content is realized by cutting off the hydrogen, adding liquid air to a trap provided for condensing the water vapor as shown in fig. 3c. When the pressure is reduced to a minimum, the metal is poured.

An 0.025 O, 0.0001 H, 0.01 N, gas analysis is typical of hydrogen and carbon reduced melts. Slight variations in gas analysis of materials melted in different ways indicate to some extent limitations in accuracy of the vacuum-fusion methods employed for the analysis.

The curves in fig. 4 illustrate the usual changes in pressure and temperature v. time for carbon-treated alloys melted in a small furnace. The pressure curves are similar to curves of carbon-treated samples in the large furnace except that the pressures were higher in the large machine, as shown in fig. 5.

The pressure would rise slightly during heating, indicating some evolution of gases before melting. The degree of rise is, of course, dependent on pumping speed, etc. After melting alloys of the types that contain appreciable quantities of chromium, the pressure rise was slight, provided no carbon was employed. The initial rise in pressure would be expected from several sources: Evolution of gases from the crucible; coil insulation (minor because it is water cooled); evolution of absorbed gases from the surfaces of the vacuum chamber and parts that were heated by radiation from the heated charge; and, probably most important, the outgassing of the charge itself which took place at low pressure.

At some temperature between room temperature and the melting point, outgassing would subside. Solubility of the gases in these metals, of course, decreases with a decrease in pressure but increases with an increase in temperature; therefore, a curve of the type shown in fig. 5 would be expected. Chromium vaporizes rapidly from the molten state at even 1000 microns; hence, a slight pressure rise would be expected after melting, and would probably be accentuated by the condensation of hot metal vapor on cold surfaces causing evaporation of absorbed gases.

It is assumed in this discussion that the heating rate is slow enough to allow considerable diffusion of gases during heating so that equilibrium is approached at the higher temperatures. Naturally, if the metal charge were heated instantaneously to the melting point, the evolution of gases would take place essentially at the melting point. It is assumed that the increase in solubility due to the temperature increase is not as great as the decrease in solubility due to the decrease in pressure.

At the melting point, diffusion is rapid and equilibrium is quickly reached. Superheating above the melting point causes an increase in solubility, and, if the melt is quenched from a very high temperature, the final gas content, although the alloy is vacuum melted, can be quite high. If the metal is cooled slowly in the vacuum

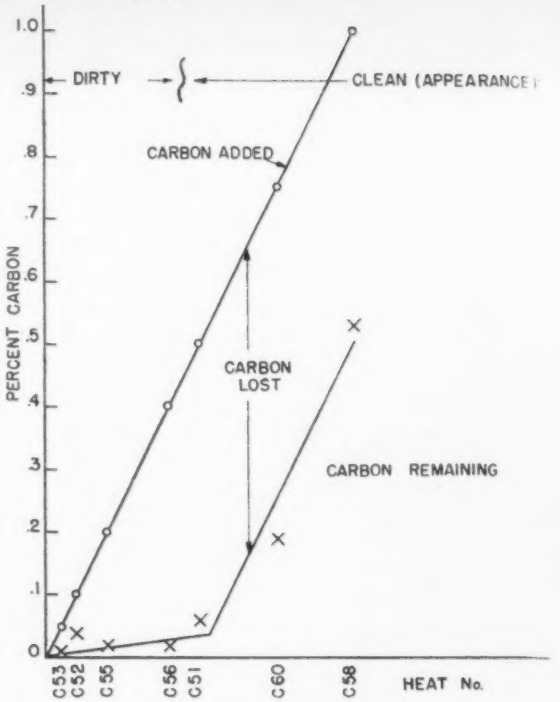

FIG. 6 - Curves showing carbon loss in deoxidizing a series of 70 pct Ni-30 pct Cr alloys with carbon in vacuum melting tests.

system after a superheated sojourn, evolution of gas will take place during cooling and obvious bubbling will occur upon solidification In vacuum melting, therefore, the best practice seems to be similar to the practice sometimes employed in commercial melting; i.e., vary the metal temperature above and below the freezing point and finally rapidly superheat to the minimum temperature necessary for pouring and cast quickly.

Refer to the curves in fig. 5. When the metal is poured through a ceramic funnel into a ceramic mold, the pressure rises rapidly to nearly 1000 microns, primarily because of the evolution of absorbed gases and water vapor from the rapidly heated ceramic mold. No doubt some contamination of the metal takes place in this environment. The metal, however, is cooled during this period and also evolves a small quantity of gases. The pressure rise caused by the evolution of gas from the cooled metal is obscured. The change in pressure caused by the cooling metal when cast in the large furnace cannot be isolated from that caused by the heated ceramics.

The curve in fig. 6 indicates the amount of carbon lost from several melts to which different carbon contents were added. Twice the quantity of carbon theoretically needed to react with the oxygen in the melts is consistently used up, but not necessarily by reaction with the metal oxides. Excess carbon is lost by oxidation in the low pressure oxidizing atmosphere.

Vacuum melting is a relatively new technique for manufacturing high-purity alloys. It is a fundamentally sound principle because it offers the opportunity to minimize the detrimental effects of the atmosphere. When employed in conjunction with other techniques, it holds great promise in offering a way to manufacture alloys with minimum quantities of extraneous elements.

The *Tin* he loves to touch....

THERE'S a feeling of real satisfaction in working up Youngstown Electrolytic Tinplate.

Gauge is precisely correct and uniformly accurate, so there's no jamming or sticking. Ductility and tensile strength are balanced just right, so there's no tearing, breaking, cracking or creasing in the forming machines, even on sharp angle bends, or 180° turns. The smooth, tin coating of the metal, with its uniformly even luster, takes lacquer perfectly. In short, from first to last, it's a genuine pleasure to handle Youngstown Electrolytic Tinplate.

No other material is available in the vast quantities required, at such low cost, to package and preserve the world's perishable products. You can depend on cans, caps and crowns made of Youngstown Electrolytic Tinplate for sure and lasting protection.

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Waste Water Treatment By Steel Plants Aids In Water, Chemicals Reuse

Pittsburgh

• • • **Many steel** and metalworking plants are facing up to a big problem in preventing stream pollution in the years ahead. Until recently many waste treatment systems have been installed out of a sense of duty to the community. Now in several states the law requires mills and factories to make positive plans for treatment of harmful wastes that are normally dumped into the nearest river.

Aside from ending stream pollution such treatment systems show other benefits to industry, according to Charles F. Hauck of Hall Laboratories, Pittsburgh. Mr. Hauck, who is an authority on process water treatment, recently finished a survey on such installations in steel mills and fabricating shops.

An Illinois bolt and nut factory made a study to quiet public clamor about acid in the river. Tests showed a 4 pct concentration of sulfuric acid in the waste water from the pickling department—a normal figure for a similar operation. The company ended complaints by "rescue" and reuse of the pickling acid, reducing the acid concentration to ¾ of 1 pct. Consumption of alkalies used to neutralize the acid was also reduced.

A big West Coast steel plant in an area where raw water is limited, recirculates cooling water and reuses the discharge from its sanitary and industrial waste treatment works. The only loss from the drinking and mill water circuits is from windage and boiler blowdown. Hardness is controlled through a cold process softener.

An Ohio steel mill goes this one better: It retains all its water, even including boiler blowdown and ash spray waste water. Mr. Hauck reports that compressor and other cooling water can be well used at increasing temperature levels. Process water can be used at increasing concentration levels.

Another wrinkle that is getting more attention where water is not plentiful is pumping cooling water back into the ground for later use. On Long Island there are more than 250 of these wells, according to U. S. Geodedic Survey engineers.

Bethlehem Steel Co. has cut down on demand from its Sparrows Point

wells by using treated sewage. The company found that the water table at the plant there was falling seriously. It dropped from 10 ft in 1898 to 150 ft in 1940. The mill depended heavily on this supply—pumped 20 million gal a day from it. Salt water contamination was also aggravating.

Bethlehem licked its problem by buying from 20 to 40 million gal of treated water daily from the Back River Municipal Sewage Plant. It has been able to cut the rate of withdrawal from its underground water resources from 15,000 to 3500 gpm. The water table was restored to a comfortable level of 80 ft.

Quite often, Mr. Hauck says, recovery of valuable materials won't pay for the treatment system. But he estimates that the steel industry's total bill at current operating rates would not exceed $12 million for initial investment, operation and maintenance of systems to treat all its harmful steel plant wastes.

U. S. Public Health Service figures, following a study of acid mine drainage in the Ohio River Valley, show a heavy annual damage bill. The report lists total annual damage at $364,000 for domestic water supplies; $407,000 for industrial water supplies; $1,143,000 for damage to steamboats and barges and another $157,000 in damage to power plants and other installations.

In 1946 a study of expenditures for treatment chemicals for water at Wheeling, W. Va. showed that their cost had risen from about $2.55 per million gal of water in 1938-1939 to approximately $6.65 in 1943-44. From this sharp rise, even allowing for rising costs, it may be assumed that industry in the Ohio Valley is paying substantial sums, directly and indirectly, for using grossly contaminated water.

Work Stoppages Growing

Washington

• • • **Reversing the last** quarter trend, about 175 new work stoppages involving 75,000 workers were reported to the Labor Dept. in January as against 120 stoppages in December affecting 30,000 workers. Including those carried over into the new year, about 250 strikes were in effect, at one time or another, during January 1948.

Report on Japanese Industry Now Under Government Study

Washington

• • • **The Government** is studying the recommendation of a group of American businessmen that the Japanese steel industry surrender 6,050,000 metric tons of producing capacity as reparations and retain 8,150,000 metric tons of capacity for that country's own needs.

Officials of the Departments of State and Army are considering the new report on Japan's industry, which was prepared by Overseas Consultants, Inc., of New York, N. Y., an organization of engineering and appraisal firms.

The report recommends for retention 2,000,000 tons of pig iron capacity, 3,500,000 tons of steel ingot capacity, and 2,650,000 tons of rolling capacity. It proposes that reparations include 1,600,000 tons of pig iron capacity, 2,900,000 tons

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NO TIPPING: ***The only tipping here is that of the coin-operated shoe shine machine which has been opened for inspection. Designed and built on the West Coast, the machine shines both shoes in one minute.***

of ingot capacity, and 1,550,000 tons of rolling capacity.

Secretary of the Army Royall identified Overseas Consultants as an organization engaged by the Army to survey Japan's industrial potential, Japan's industrial requirements for economic recovery and stabilization, and availability of Japanese industrial assets for reparations removals.

The Army plans to publish the full 175-page report submitted by the engineering group, Mr. Royall said. He pointed out that neither the Army nor the State Dept. has acted on the report yet.

Among the members of Overseas Consultants, Inc., are Standard Research Consultants, Inc.; Jackson & Moreland; American Appraisal Co.; F. H. McGraw & Co.; Coverdale & Colpitts; Ford, Bacon & Davis, Inc.; Sanderson & Porter; Stone & Webster Engineering Corp.; J. G. White Engineering Corp.; Ebasco Services, Inc., and Madigan & Hyland.

Clifford S. Strike, president, F. H. McGraw & Co., is president of Overseas Consultants, Inc. The group began its studies in Tokyo in July 1947 and ended its field investigation in December.

Construction Rate Climbs

Washington

• • • **New construction** during February is estimated at $959 million, showing the normal seasonal decline but registering a 21 pct increase over February 1947; the total for the first two months 1948 approximates $2 billion.

Privately financed February building accounted for $785 million of the total, according to the Commerce Dept. Residential building totaled $400 million; industrial, $125 million; and commercial such as stores, garages, etc., about $90 million.

Meanwhile, the Bureau of Labor Statistics reports that construction costs increased 18 pct during 1947 and the trend is still upward. The Dept's. index now stands at 206.5 above 1939.

Exports Up $4.4 Billion

Washington

• • • **Exports reached** a new peacetime peak in 1947, according to the Office of Business Economics, with a final total of $19.6 billion. A large portion of the $4.4 billion increase over 1946 is credited to increased prices. Imports rose from $7.1 billion in 1946 to $8.3 billion.

Army Posts Offer Scrap

Washington

• • • **Under revised procedure,** consumers and buyers of certain Army-held copper base alloy scrap may apply directly to the appropriate post, camp or station salvage officer and request invitations to bid on future offerings of such material.

Bidders will be eligible only if buying to meet their own current domestic requirements or for resale to others for such purposes. This procedure applies to the following specific types of domestic copper base alloy scrap: Cartridge brass ingots, slabs, discs, bars, partly or completely manufactured ammunition cases, fired cases and remelt ingot; and, gilding metal mill forms or remelt ingots.

Sell Ordnance Plant

Washington

• • • **Sale of the** $27 million Ozarks Ordnance Plant at El Dorado, Ark., for $10.5 million cash has been approved by WAA. Lion Oil Co. was the purchaser.

SOUVENIRS: *A London firm has been commissioned to strike 10,000 bronze souvenir medals for visitors at the Olympic games in London next summer. Photo shows inspection of the medals.*

PERSONALS

(Continued from page 99)

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• **M. G. Sternberg,** formerly executive vice-president, has been elected president of Continental Foundry & Machine Co., Chicago. **H. A. Forsberg, B. P. Hammond** and **A. E. Murton** have been elected vice-presidents of the company.

• **Frank J. Whelan** has been named vice-president of Worthington Pump and Machinery Corp., Harrison, N. J.

• **Robert C. Myers** has been appointed manager of the market development division of Carnegie-Illinois Steel Corp., Pittsburgh, succeeding R. J. Ritchey.

• **Peter Altman** has been named vice-president in charge of Multi-Tool Div. of the Continental Motors Corp., Detroit.

• **Jack J. Caraway,** formerly sales manager, has been promoted to vice-president and sales manager of Peden Iron & Steel Co., Houston.

• **John Stewart,** president of Donner Corp., Philadelphia, has been elected a director of Pittsburgh Steel Co., Pittsburgh.

• **Norman Weinstein** has joined Calumet Iron & Supply Co., East Chicago, Ind., as vice-president in charge of their Calisco Engineering Div. Mr. Weinstein was formerly with the Trane Co.

• **Henry H. Ziesing,** vice-president in charge of sales of the Midvale Co., Philadelphia, has been elected a director of the company.

• **C. E. Howes** has been named manager of sales, steel equipment products, Berger Mfg. Div., Republic Steep Corp., Canton, Ohio. Mr. Howes has been associated with the sales department of Berger since 1922.

• **Charles L. Sherman,** district supervisor of production planning, American Steel & Wire Co., Worcester, has retired after being associated with the company for 44 years.

• **William E. Wilson,** who has been sales manager of Acme Electric Corp., Cuba, N. Y., for the past 3 years, has been elected to the office of vice-president in charge of sales.

PERSONALS

• **Willard R. Gates** has been appointed representative in the western Michigan territory for the Wheel Trueing Tool Co., Detroit.

• **Raymond T. Doherty** has joined the general division of York-Shipley, Inc., York, Pa., as supervisor of sales to manufacturers and national accounts.

• **Irving J. Le Beau,** former assistant sales manager of the Wisconsin Motor Corp., Milwaukee, has been appointed export sales manager and is succeeded by **R. J. Fellows.**

• **Harris Kruse,** head of the cost accounting department at Snap-On Tools Corp., Kenosha, Wis., has been promoted to plant manager of the firm's Newport, Pa. factory.

• **Peter P. Weidenbruch** has been appointed general manager of the Damrow Bros. Dairy Equipment Co., Fond du Lac, Wis., to succeed **E. C. Damrow,** who has resigned to become chairman of the board of directors.

• **William P. Lieser,** former mechanical superintendent at the Milwaukee branch of the Iron Fireman Mfg. Co., Portland, Ore., has been appointed Milwaukee branch manager.

• **E. Richard Walter** has been appointed sales manager of Powdered Metal Products Corp., Franklin Park, Ill. Mr. Walter formerly was chief metallurgist.

• **Rolland D. Koenitzer** has been appointed assistant chief engineer of the heat transfer department of Brown Fintube Co., Elyria, Ohio. He was recently assistant chief engineer of the McCord Corp.

• **Julius A. Smith** has been promoted from sales representative to sales supervisor of the Southern States Iron Roofing Co., Savannah, Ga.

• **H. E. Heywood** has been appointed manager, general sales office, National Supply Co., Toledo. He will assist in the overall operation of the sales office and continue supervision of the inventory control department. Mr. Heywood joined National Supply in 1923.

• **Hans Bohuslav** has joined Engineering Controls, Inc., Los Angeles, as vice-president in charge of engineering. For the past 5 years he was vice-president in charge of engineering of Sterling Engine Co.

• **Leon Norfleet** has been named industry manager of the marine division of Reynolds Metals Co., Louisville. He was with Reynolds Metals purchasing office as assistant purchasing agent at the time of his new appointment.

• **H. S. Robertson** has been elected vice-president of Harbison-Walker Refractories Co., Pittsburgh. **F. W. Sheppard** has been appointed general sales manager, and **C. A. Brashares,** sales manager of the Birmingham district of the company. Mr. Robertson has been associated with Harbison-Walker since 1916. In 1940 he was appointed general sales manager, and since 1943 he has been a director of the company. Mr. Sheppard joined the company in 1922 and since 1926 has been Birmingham district sales manager. Mr. Brashares went into the research department of Harbison-Walker in 1928. He has most recently been associated with the Pittsburgh office.

• **Allan W. Low** has been appointed general superintendent of a new formaldehyde plant of Monsanto Chemical Co. at Springfield, Mass. Mr. Low had been associated with the General Chemical Div. of Allied Chemical & Dye Corp. for the past 12 years.

• **Harold A. Jope** has been appointed sales representative for the western half of Connecticut by the Hendrick Mfg. Co. of Carbondale, Pa.

• **Lester Samstag** has been appointed production metallurgist at General Aluminum Mfg. Co., Cleveland. He came to General as metallurgical production engineer. **Robert E. Keith** has been appointed metallurgical sales engineer of the company.

• **Jay M. Powell** has been appointed assistant to N. Martin Steffens, director of purchases of Geuder, Paeschke & Frey Co., Milwaukee.

• **Richard F. White** has retired as assistant to the president of Mullins Mfg. Corp., Warren, Ohio, and **Howard C. Wolf** has been named to succeed him. Mr. White has been with Mullins for 23 years. In 1929 he was elected to the board of directors, a position he still holds. He will continue to serve as consultant to the corporation from his office in Washington. Mr. Wolf has been doing special product and market survey work for Mullins during the past 2 years. He has been associated with Mullins and Youngstown Pressed Steel Co., which became a part of Mullins in 1937, for 20 years.

PERSONALS

• **A. L. Gutterson, J. B. Johnson** and **C. N. Safford** have been elected directors of Lovejoy Tool Co., Inc., Springfield, Vt. Mr. Safford has been elected president and C. E. **Hopkins,** treasurer of the corporation.

• **Robert G. Tabors** has been appointed sales manager of the hydraulic press and power tools section of the Baldwin Locomotive Works at Eddystone, Pa. He had been associated with Baldwin from 1937 until World War II. Until recently Mr. Tabors was sales manager for the William H. Harman Corp., Wilmington.

• **Fred P. Biggs** has been appointed first vice-president of Brake Shoe & Castings Div. of the American Brake Shoe Co., New York. Mr. Biggs has been with Brake Shoe since 1916. In addition to his new duties, he will continue as vice-president in charge of sales of the Brake Shoe & Castings and Southern Wheel Divs., positions which he has held since 1944.

• **Robert F. Nelson** has been elected a director and vice-president in charge of all engineering and manufacturing operations for American Type Founders, Inc., Elizabeth, N. J. Before joining American Type Founders, Mr. Nelson was vice-president and assistant to the president, and a director, of R. G. LeTourneau, Inc.

• **William R. Odell, Jr.,** treasurer of International Harvester Co., Chicago, has been elected a vice-president. **Peter V. Moulder,** executive vice-president since 1946, has been nominated a member of the board of directors.

• **C. B. Vernooy** has been appointed comptroller of Geneva Steel Co., Geneva, Utah, to succeed **James E. Butler,** who has been serving both Geneva and Columbia Steel Co. in that post. Mr. Butler will continue as comptroller for Columbia with offices in San Francisco. Mr. Vernooy formerly was comptroller and secretary of U. S. Steel Supply Co. in Chicago.

• **Bert E. Brashares** has been appointed sales engineer in the steel castings department, Continental Foundry & Machine Co., Pittsburgh. Mr. Brashares was most recently associated with the Otis Casting Div. of Jones & Laughlin Steel Corp. in Cleveland.

PERSONALS

• **Ann E. Hamilton** has been named sales promotion manager of the Ajax Electric Co., Philadelphia.

• **Dr. Charles W. Rippie** has joined Lukens Steel Co., Coatesville, Pa., as a member of its sales development staff. Previously Dr. Rippie had been head of the technical service of the research and development division of Merck & Co., Rahway, N. J.

• **Nicholas E. Meyer** has been appointed manager of sales for Oil Well Supply Co.'s Wilson-Snyder Div. Mr. Meyer, whose headquarters will be at Braddock, Pa., replaces **Howard W. Booth,** who has been transferred to the export division of Oil Well. Mr. Meyer joined the company in 1928.

• **Haskell C. Carter** has been named vice-president in charge of manufacturing, Iron Fireman Mfg. Co., Cleveland. Mr. Carter joined Iron Fireman 22 years ago in a supervisory capacity.

• **Wilmer H. Cordes,** manager, market development division, American Steel & Wire Co., Cleveland, has been named to assume the added duties of manager of the advertising division of that U. S. Steel subsidiary.

• **J. E. Ashman** has been elected vice-president and controller of Rockwell Mfg. Co., Pittsburgh. **E. W. Meyers** has been elected secretary and **M. J. Carl,** treasurer. **Paul A. Wick** and **I. C. Rowe** have been named assistant secretaries.

• **Dave Hardie** has been appointed manager of the Los Angeles division of Bethlehem Supply Co. of California. **Lynn Guttery** has been appointed to be manager of the Coast division and **Roger Brown** will manage the San Joaquin division for Bethlehem Supply.

• **Barclay K. Read,** former assistant sales manager of the Shell Chemical Corp., San Francisco, has been advanced to the position of sales manager upon the retirement of **Sidney S. Lawrence.**

• **Marshall E. Beaman,** formerly director of industrial relations for North American Aviation, Inc., has joined Ford Motor Co., Dearborn, Mich., as assistant manager of in-

dustrial relations. **Robert S. Dunham,** Ford director of salaried personnel, also has become assistant manager of industrial relations, under Mel B. Lindquist.

• **Daniel Bohm** has been named general superintendent of Mullins Mfg. Corp.'s Salem, Ohio, plants. Mr. Bohm has been superintendent of Mullins' Plant One at Salem since 1937. He has been associated with Mullins for 37 years.

OBITUARY

• **Alphie E. Getz,** 53, associated with Keystone Steel & Wire Co., Peoria, Ill., for the past 31 years, the past 14 years as openhearth superintendent, died Feb. 25.

• **William H. Leland,** 82, president of Leland-Gifford Co., Worcester Mass., died Feb. 23.

• **William H. Wetsell,** 66, president of Cambridge Screw Sales Co., and vice-president of Cambridge Screw Co., Cambridge, Mass., died Feb. 22.

• **Martin Newcomer,** 64, assistant director of research of the Winchester Repeating Arms Co. division of Olin Industries, Inc., New Haven, Conn., died suddenly Feb. 24.

• **S. A. Cochran,** 71, president of Frank Samuel & Co., Inc., Philadelphia, died Feb. 28.

• **Harold E. Long,** 61, manager of the Nash Motors Div. plant at Kenosha, Wis., since 1943, died Feb. 28.

• **Herbert H. Frey,** vice-president in charge of sales of Globe-Union, Inc., Milwaukee, died Feb. 28. He started with the firm 27 years ago.

• **Leslie A. Wiggins,** 55, vice-president in charge of the Rome Div. of Revere Copper & Brass, Inc., Rome, N. Y., died recently.

• **Luciano Selmi,** 68, Great Lakes Steel Corp. metallurgical consultant, Ecorse, Mich., died recently.

• **Carl L. Mattison,** 61, president of the Mattison Machine Works, Rockford, Ill., since 1939, died recently.

• **Kenneth N. Cook,** assistant sales manager of the Rollway Bearing Co., Inc., Syracuse, died Mar 5. He had been with the company since 1927.

The Iron Age Buyers' Guide

Another section of the Buyers' Guide is presented herewith. Previous sections have appeared weekly in THE IRON AGE beginning Jan. 1, 1948. Additional sections of the Guide will appear weekly.

E

Yale & Towne Mfg. Co., 4535 Tacony St., Philadelphia.

Emery Paste

Allied Industrial Products Co., 620 North Michigan Ave., Chicago 11.

Beam-Knodel Co., 195 Lafayette St., New York 12.

The Bias Buff and Wheel Co., Division Riegel Textile Corp., 3464-66 Hudson Boulevard, Jersey City 7, N. J.

Formax Mfg. Co., 3000 Bellevue St., Detroit 7.

HANSON-VAN WINKLE-MUNNING CO., Matawan, N. J.

Kocour Co., 4800 S. St. Louis Ave., Chicago.

Manderscheid Co., 810 Fulton St., Chicago 7.

Nankervis, Geo. L., Co., 5442 Second Blvd., Detroit 2.

Puritan Manufacturing Co., Waterbury, Conn.

Sommers Bros. Manufacturing Co., 3139-41-43 No. Broadway, St. Louis 7.

Worthington Co., 317 Dwight St., Springfield, Mass.

Enamels

Arco Co., 7313 Bessemer Ave., Cleveland 4.

BETTER FINISHES & COATINGS, INC., 268-276 Doremus Ave., Newark 5, N. J.

DU PONT, E. I., De NEMOURS & CO., INC., Explosives Dept., Wilmington 98, Del.

Egyption Lacquer Mfg. Co., 1270 6th Ave., Rockefeller Center, New York 20.

Foundry Rubber, Inc., 1050 30th St. N. W., Washington 7, D. C.

Frost Paint & Oil Corp., 1209 N. E. Tyler St., Minneapolis 13.

GLIDDEN COMPANY, 11001 Madison Ave., Cleveland 2.

Hilo Varnish Corp., 42 Stewart Ave., Brooklyn 6.

PITTSBURGH PLATE GLASS CO., PAINT DIV., Grant Bldg., Pittsburgh 19.

Reilly Tar & Chemical Corp., Merchants Bank Bdg., Indianapolis 4, Ind.

Standard Varnish Works, 2600 Richmond Terr., Port Richmond 3, S. I., N. Y.

St. Louis Surfacer & Paint Co., 4200 Arlington Ave., St. Louis 20.

Enamel Strippers

Allied Industrial Products Co., 620 North Michigan Ave., Chicago 11.

American Chemical Paint Co., Ambler, Pa.

Enthone, Inc., 442 Elm St., New Haven 11, Conn.

Fidelity Chem. Prod. Corp., 430 Riverside Ave., Newark 4, N. J.

GLIDDEN COMPANY, 11001 Madison Ave., Cleveland 2.

PENNSYLVANIA SALT MFG. CO., 1000 Widener Bldg., Philadelphia 7.

PITTSBURGH PLATE GLASS CO., PAINT DIV., Grant Bldg., Pittsburgh 19.

Puritan Manufacturing Co., Waterbury, Conn.

Quaker Chemical Products Corp., Conshohocken, Pa.

Sommers Bros. Manufacturing Co., 3439-41-43 No. Broadway, St. Louis 7.

Stull, A. J., & Co., 4420 Paul St., Frankford, Philadelphia 24.

Turco Products, Inc., P. O. Box 2649 Terminal Annex, Los Angeles 54.

WYANDOTTE CHEMICALS CORP., Wyandotte, Mich.

Thompson & Co., 1085 Allegheny Ave., Oakmont, Pa.

Tremco Mfg. Co., 8710 Kinsman Rd., Cleveland 4.

UNITED CHROMIUM INC., 51 East 42nd St., New York 17.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, East Pittsburgh, Pa.

End Mills

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.

Brubaker, W. L., & Bros. Co., Railroad St., Millersburg, Pa.

CHICAGO LATROBE TWIST DRILL WKS., 411 W. Ontario St., Chicago 10.

Gorton, George, Machine Co., Racine, Wis.

Melin Tool Co., Inc., 1331 Phillips, S. W. Grand Rapids 7, Mich.

Millersburg Reamer & Tool Co., Millersburg, Pa.

Union Twist Drill Co., Athol, Mass.

Engineering Services

Associated Development & Research Corp., 150 Broadway, New York 7.

BAIRD ASSOCIATES, INC., 30 University Road, Cambridge 38, Mass.

BOYNTON, A. J., & CO., 58 E. Washington St., Chicago 2.

DOMINION BRIDGE CO., LTD., Montreal, Canada.

KORFUND CO., 48 32nd St., Long Island City 1, N. Y.

LOFTUS ENGINEERING CO., 610 Smithfield St., Pittsburgh.

SELAS CORP. OF AMERICA, Erie Ave., Philadelphia.

STONE & WEBSTER ENGINEERING CO., 90 Broad St., New York 4.

VINCO CORP., 9100 Schaefer Highway, Detroit 27.

Engines, Diesel

Detroit Diesel Engine Division, General Motors Corp., 13400 West Outer Drive, Detroit 23.

FAIRBANKS, MORSE & CO., S. Michigan Ave., Chicago 5.

General Machinery Corp., Hooven, Owens, Rentschler Div., Hamilton, Ohio.

Engines, Gasoline

Briggs & Stratton Corp., Milwaukee 1.

Burgess Battery Co., Handicraft Division, 180 N. Wabash Ave., Chicago 1.

Clinton Machine Co., Clinton, Mich.

Wisconsin Motor Corp., Milwaukee 14.

Engraving Machines

Aaron Machinery Co., Inc., 45 Crosby St., New York 12.

Addressograph-Multigraph Corp., 1200 Babbitt Rd., Cleveland 17.

BOTWINIK BROS. OF MASS. INC., (Distributors), 5 Sherman St., Worcester 1, Mass.

Gaertner Scientific Corp., 1233 W. Wrightwood Ave., Chicago 14.

Gorton, George, Machine Co., Racine, Wis.

Interstate Machinery Co., 1435 W. Pershing Rd., Chicago 9.

Miles Machinery Co., 2025 E. Genesee Ave., Saginaw, Mich.

Etchers, Electric

Annis, R. B., Co., 1101 N. Delaware St., Indianapolis 1, Ind.

Burgess Battery Co., 188 N. Wabash Ave., Chicago.

Ideal Commutator Dresser Co., Park Ave., Sycamore, Ill.

Gorton, George, Machine Co., Racine, Wis.

Martindale Electric Co., Hird St., Cleveland.

U. S. STONEWARE CO., PROCESS EQPT. DIV., E. Tallmadge Ave., Akron, Ohio.

Excavating Machines, Crane

Marion Power Shovel Co., Marion, Ohio.

MICHIGAN POWER SHOVEL CO., Benton Harbor, Mich.

Thew Shovel Co., Lorain, Ohio.

Trackson Company, 3333 S. Chase Ave., Milwaukee 7.

Unit Crane & Shovel Corp., Milwaukee 14.

Excavating Machines, Dragline

Marion Power & Shovel Co., Marion, Ohio.

MICHIGAN POWER SHOVEL CO., Benton Harbor, Mich.

OSGOOD CO., GENERAL EXC. CO., Marion, Ohio.

Thew Shovel Co., Lorain, Ohio.

Unit Crane & Shovel Corp., Milwaukee 14.

Excavating Machines, Clamshell

Marion Power Shovel Co., Marion, Ohio.

Michigan Power Shovel Co., Benton Harbor.

OSGOOD CO., GENERAL EXC. CO., Marion, Ohio.

Thew Shovel Co., Lorain, Ohio.

Unit Crane & Shovel Corp., Milwaukee 14.

Excavating Machines, Power Shovel

Athey Products Corp., 5631 W. 65th St., Chicago 38.

Marion Power & Shovel Co., Marion, Ohio.

MICHIGAN POWER SHOVEL CO., Benton Harbor, Mich.

OSGOOD CO., GENERAL EXC. CO., Marion, Ohio.

Thew Shovel Co., Lorain, Ohio.

Trackson Company, 3333 So. Chase Ave., Milwaukee 7.

Unit Crane & Shovel Corp., Milwaukee 14.

Exhaust Fans

AMERICAN BLOWER CORP., Detroit 32, Mich.

Beam-Knodel Co., 195 Lafayette St., New York 12.

BUYERS' GUIDE

• Every company in the metalworking industry is urged to check this section of the new IRON AGE Metalworking Buyers' Guide, and send in corrections and additions to assure complete accuracy in the first reprint of the directory. Forward corrections to THE IRON AGE, Attention Buyers' Directory, 100 E. 42nd St. New York 17.

BOTWINIK BROS. OF MASS. INC., (Distributors), 5 Sherman St., Worcester 1, Mass.

Burt Mfg. Co., 920 S. High St., Akron 11, Ohio.

Champion Blower & Forge Co., Harrisburg Ave., Lancaster, Pa.

DeBothezat Fans Div., American Machine & Metals, Inc., East Moline, Ill.

Delco Appliance Div., General Motors Corp., 391 Lyell Ave., Rochester 1, N. Y.

Despatch Oven Co., 613-23 S. E. 8th St., Minneapolis 14.

Diehl Mfg. Co., 1134 Finderne Ave., Somerville, N. J.

Duriron Co., Inc., Dayton 1, Ohio.

Falstrom Co., Main Ave., Passaic, N. J.

Galbreath Machinery Co., (Distributors) Empire Bldg., Pittsburgh, Pa.

International Clay Machinery Co., Dayton 1 Ohio.

International Engineering, Inc., Dayton, Ohio.

Joy Manufacturing Co., Sullivan Division, Michigan City, Ind.

Mahr Mfg. Co., Div. Diamond Iron Works, 1729 No. 2nd St., Minneapolis 11.

Mandel, A., & Co., 37 E. 12th St., New York 3.

Parsons Engineering Corp., 2549 E. 79th St., Cleveland 4.

Powermatic Ventilator Co., 4014 Prospect Ave., Cleveland 3.

Robinson Ventilating Co., Zelienople, Pa.

Rockwell, W. S., Co., 200 Eliot St., Fairfield, Conn.

Smith, F. A., Mfg. Co., Davis St., Rochester 2, N. Y.

Sommers Bros. Manufacturing Co., 3439-41-43 No. Broadway, St. Louis 7.

St. Louis Blow Pipe & Heater Co., Inc., 1948-60 N. 9th St., St. Louis 6.

Sutton, D. A., Corp., 403 Beacon Bldg., Wichita, Kan.

Trane Co., La Crosse, Wis.

Torit Manufacturing Co., Walnut & Exchange Sts., St. Paul 2, Minn.

Triangle Mfg. Co., Oshkosh, Wis.

U. S. STONEWARE CO., PROCESS EQPT. DIV., P. O. Box 350, Akron, Ohio.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, East Pittsburgh, Pa.

Exhaust Systems

American Foundry Eqpt. Co., Inc., 412 S. Byrkit St., Mishawaka, Ind.

BOTWINIK BROS. OF MASS. INC., (Distributors), 5 Sherman St., Worcester 1, Mass.

Falstrom Co., Main Ave. & D. L. & W. R.R., Passaic, N. J.

Metallizing Engineering Co., 38-14 30th St., Long Island City 1, N. Y.

Parsons Engineering Corp., 2549 E. 79th St., Cleveland 4.

St. Louis Blow Pipe & Heater Co., Inc., 1948-60 N. 9th St., St. Louis 6.

Torit Manufacturing Co., Walnut & Exchange Sts., St. Paul 2, Minn.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, East Pittsburgh, 22.

WHITMAN & BARNES, DIV. OF UNITED DRILL & TOOL CORP., Detroit 16.

Explosives

AMERICAN CYANAMID & CHEMICAL CORP., INDUS. CHEM. DIV., 30 Rockefeller Plaza, New York.

Apache Powder Co., Benson, Ariz.

Atlas Powder Co., Market St., Wilmington, Del.

Austin Powder Co., Rockefeller Bldg., Cleveland.

Columbia Powder Co., Tacoma, Wash.

du PONT, E. I., de NEMOURS & CO., EXPLOSIVES DEPT., 10th & Market Sts., Wilmington 98, Del.

Egyptian Powder Co., East Alton, Ill.

Hercules Powder Co., Market St., Wilmington, Del.

King Powder Co., First National Bank Bldg., Cincinnati.

National Fireworks, Inc., West Hanover, Mass.

Trojan Powder Co., Allentown, Pa.

Extinguishers, Fire (See Fire Extinguishers)

Extractors, Oil & Water

BOTWINIK BROS. OF MASS. INC., (Distributors), 5 Sherman St., Worcester 1, Mass.

Tolhurst Centrifugals Div., American Machine & Metals, Inc., East Moline, Ill.

Zurn, A. J., Mfg. Co., Erie, Pa.

Extractors, Pile

McKiernan-Terry Corp., 15 Park Row, New York 7.

Vulcan Iron Works, 327 No. Bell Ave., Chicago 12.

Extractors, Screw

CHICAGO LATROBE TWIST DRILL WKS., 411 W. Ontario St., Chicago 10.

CLEVELAND TWIST DRILL CO., 1246 E. 49th St., Cleveland 14.

GREENFIELD TAP & DIE CORP., Sanderson St., Greenfield, Mass.

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass.

New Britain Machine Co., New Britain, Conn.

Plomb Tool Co., Washington St., Los Angeles.

Ridge Tool Co., Clark St., Elyra, Ohio.

WHITMAN & BARNES, DIV. OF UNITED DRILL & TOOL CORP., Detroit 16.

Eye Shields

Ajax Steel & Forge Co., 205 Adair St., Detroit 7.

Allied Weld-Craft, Inc., 401 W. South St., Indianapolis 4, Ind.

AMERICAN OPTICAL CO., Southbridge, Mass.

Beals, McCarthy & Rogers, Inc., (Distributors), 50 Terrace, Buffalo 5, N. Y.

Cleveland Tool & Supply Co., 1427 W. 6th St., Cleveland 13.

Cover, H. S., 1933 Chippewa St., South Bend 14, Ind.

Eastern Tool Supply Co., 176 Grand St., New York 13.

Hollup Corporation, 4700 W. 19th St., Chicago 50, Ill.

Industrial Products Co., 2746 N. 4th St., Philadelphia 33.

Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh.

STANLEY WORKS, STANLEY ELECTRIC TOOLS DIV., New Britain, Conn.

BUYERS' GUIDE

Face Grinders

Besley, Chas. H., & Co., 129 N. Clinton St., Chicago 6.

Blount, J. G., Co., Everett, Mass.

Bridgeport Safety Emery Wheel Co., 1299 W. Broad St., Bridgeport, Conn.

Builders Iron Foundry, 1104 Westminster St., Providence 1, R. I.

Delta Mfg. Co., Vienna & Stuetseman Aves., Milwaukee 1.

Diamond Machine Co. of Philadelphia, 2350 Aramingo Ave., Philadelphia 25.

Fox Grinders, Inc., 1699 Olivier Bldg., Pittsburgh.

General Engineering & Mfg. Co., 1523 S. 10th St., St. Louis 4.

General Machinery Corp., 146 Lesfield St., Boston.

Hammond Machinery Builders, Inc., 1605 Douglas Ave., Kalamazoo 54, Mich.

Hanchett Mfg. Co., 1943 Gardner St., Big Rapids, Mich.

Hisey Wolf Machine Co., Marshall & Colerain Aves., Cincinnati, Ohio.

Jefferson Machine Tool Co., 674 West 4th St., Cincinnati 3, Ohio.

Lippman Engineering Works, 732-42 Edmond St., Pittsburgh.

Mummert-Dixon Co., Philadelphia St., Hanover, Pa.

Oliver Instrument Co., E. Maumee St., Adrian, Mich.

SELLERS, WM., & CO., INC., 1600 Hamilton St., Philadelphia 30.

THOMAS MACHINE MFG. CO., Etna Branch P. O., Pittsburgh 23.

Vonnegut Molder Co., Madison Ave. at Carey St., Indianapolis, Ind.

WALKER TURNER CO., INC., E. 5th St., Plainfield, N. J.

Facing Heads

Mummert-Dixon Co., Philadelphia & Gay Sts., Hanover, Pa.

Fans, Dust Collecting

AMERICAN BLOWER CORP., Detroit 32.

International Engineering, Inc., Dayton, Ohio.

Parsons Engineering Corp., 2549 E. 79th St., Cleveland 4.

Robinson Ventilating Co., Zelienople, Pa.

RUEMELIN MFG. CO., Palmer St., Milwaukee 12.

Sommers Bros. Manufacturing Co., 3439-41-43 N. Broadway, St. Louis 7.

STANDARD ELECTRICAL TOOL CO., 2505 River Rd., Cincinnati 4.

St. Louis Blow Pipe & Heater Co., Inc., 1918-60 N. 9th St., St. Louis 6.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, E. Pittsburgh.

Fans, High-Temperature Recirculating

International Clay Machinery Co., Dayton 1, Ohio.

Mahr Mfg. Co., Div. Diamond Iron Works, 1729 N. 2nd St., Minneapolis 11, Minn.

MICHIANA PRODUCTS CORP., Michigan City, Ind.

Robinson Ventilating Co., Zelienople, Pa.

Rockwell, W. S., Co., 200 Eliot St., Fairfield, Conn.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, East Pittsburgh, Pa.

Fans, Ventilating (See Exhaust Fans)

Feed Fingers, Screw Machine

EASTERN MACHINE SCREW CORP., New Haven 6, Conn.

GENERAL DIE & STAMPING CO., 262-272 Mott St., New York 12.

Feeders and Proportioners, Materials

Bonnot Company, 722 Mulberry Rd., S. E., Canton 2, Ohio.

Cochrane Corporation, 17th St. & Allegheny Ave., Philadelphia 32.

Feeding Equipment, Chemical

Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Cochrane Corporation, 17th St. & Allegheny Ave., Philadelphia 32.

Felt, Industrial

AMERICAN FELT CO., Glenville, Conn.

Felt Polishing Belts

Allied Industrial Products Co., 620 N. Michigan Ave., Chicago 11.

Sommers Bros. Manufacturing Co., 3439-41-43 N. Broadway, St. Louis 7.

Felt Polishing Wheels

Allied Industrial Products Co., 620 N. Michigan Ave., Chicago 11.

Bacon Felt Co., 22 Grove Pl., Winchester, Mass.

Beals, McCarthy & Rogers, Inc. (Distributors), 50 Terrace, Buffalo 5, N. Y.

Beam-Knodel Co., 195 Lafayette St., New York 12.

Bias Buff and Wheel Co., Division Riegel Textile Corp., 3464-66 Hudson Blvd., Jersey City 7, N. J.

Cleveland Tool & Supply Co., 1427 W. 6th St., Cleveland 13.

Columbian Rope Co., Inc., Allied Products Div., Auburn, N. Y.

Formax Mfg. Co., 3000 Bellevue St., Detroit 7.

GORDON, CLAUD S., CO., 3000 S. Wallace St., Chicago 16.

HANSON-VAN WINKLE MUNNING CO., Matawan, N. J.

Interstate Machinery Co., 1435 W. Pershing Rd., Chicago 9.

Manderscheid Co., 810 Fulton St., Chicago 7.

Nankervis, Geo. L., Co., 5442 Second Blvd., Detroit 2.

PRATT & WHITNEY DIV., NILES-BEMENT-POND CO., West Hartford 1, Conn.

Puritan Manufacturing Co., Waterbury, Conn.

Rhodes, James H., & Company, 157 W. Hubbard St., Chicago 10.

Sommers Bros. Manufacturing Co., 3439-41-43 N. Broadway, St. Louis 7.

Stevens, Frederick B., Inc., 510 3rd St., Detroit 26.

WESTERN FELT WORKS, 4029-4135 Ogden Ave., Chicago 23.

Fences, Wire

ATLAS FENCE CO., Venango and Goule Sts., Philadelphia 34.

CONTINENTAL STEEL CORP., Kokomo, Ind.

Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.

Franklin Steel Works, P. O. Box 671, Franklin, Venango County, Pa.

PAGE STEEL & WIRE DIV., AMERICAN CHAIN & CABLE CO., Monessen, Pa.

Ferric Sulfate

DU PONT DE NEMOURS, E. I., & CO., INC., Wilmington 98, Dela.

Ferroalloys

ANACONDA COPPER MINING CO., Anaconda, Mont.

CENTRAL STEEL & WIRE CO., 3000 W. 51st St., Chicago 32.

Chromium Mining & Smelting Corp., P. O. Drawer 968, Sault Ste. Marie, Ontario.

Cliffs Corporation, Union Commerce Bldg., 14th Floor, Cleveland 14.

CLIMAX MOLYBDENUM CO., New York.

ELECTRO METALLURGICAL CO., 30 E. 42nd St., New York 17.

JACKSON IRON & STEEL CO. Jackson Ohio.

Metal Hydrides Inc., 16 Congress St., Beverly, Mass.

BUYERS' GUIDE

MOLYBDENUM CORP. OF AMERICA, Grant Bldg., Pittsburgh.

OHIO FERRO-ALLOYS CORP., Canton, Ohio.

Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

SAMUEL, FRANK & CO. INC. Harrison Bldg. Philadelphia 2.

Southern Ferro Alloys Co., 220 Chestnut St., Chattanooga, Tenn.

Steel Sales Corp., 3352 S. Pulaski Rd., Chicago 23.

TITANIUM ALLOY MFG. CO., Box C, Bridge Station, Niagara Falls, N. Y.

TOMLINSON & CO., Philadelphia.

Vanadium Corp. of America, 420 Lexington Ave., Graybar Bldg., New York 17.

Ferrochrome

Chromium Mining & Smelting Corp., P. O. Drawer 968, Sault Ste. Marie, Ontario.

ELECTRO METALLURGICAL CO., 30 E. 42nd St., New York 17.

Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

SAMUEL, FRANK, & CO., INC., Harrison Bldg., Philadelphia 2.

Steel Sales Corp., 3352 S. Pulaski Rd., Chicago 23.

Vanadium Corp. of America, 420 Lexington Ave., Graybar Bldg., New York 17.

Ferrocolumbia

ELECTRO METALLURGICAL CO., 30 E. 42nd St., New York 17.

Ferrohoron (See Boson Compounds)

Ferromanganese

BETHLEHEM STEEL CO., Bethlehem, Pa.

CARNEGIE-ILLINOIS STEEL CORP., Carnegie Bldg., 434 5th Ave., Pittsburgh 30.

ELECTRO METALLURGICAL CO., 30 E. 42nd St., New York 17.

Lavino, E. J., and Company, 1528 Walnut St., Philadelphia 2.

Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

SAMUEL, FRANK, & CO., INC., Harrison Bldg., Philadelphia 2.

Vanadium Corp. of America, 420 Lexington Ave., Graybar Bldg., New York 17.

Ferrosilicon

Belmont Smelting & Refining Works, Belmont Ave., Brooklyn.

CLEVELAND-CLIFFS IRON CO., Union Commercial Bldg., Cleveland.

Chromium Mining & Smelting Corp., P. O. Drawer 968, Sault Ste. Marie, Ontario.

ELECTRO METALLURGICAL CO., 30 E. 42nd St., New York 17.

Globe Iron Co., Jackson, Ohio.

KEOKUK ELECTRO-METALS CO., 4th St., Keokuk, Iowa.

Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

SAMUEL, FRANK, & CO., INC., Harrison Bldg., Philadelphia 2.

SOUTHERN FERRO ALLOYS CO., 2108-24 Chestnut St., Chattanooga 2, Tenn.

Steel Sales Corp., 2557 S. Pulaski Rd., Chicago.

Vanadium Corp. of America, 420 Lexington Ave., Graybar Bldg., New York 17.

Ferrovanadium

ELECTRO METALLURGICAL CO., 30 E. 42nd St., New York 17.

Vanadium Corp. of America, 420 Lexington Ave., Graybar Bldg., New York 17.

Fiber, Vulcanized, Sheet, Products, Tubes

Wilmington Fibre Specialty Co., P. O. Drawer 1028, Wilmington 99, Del.

BUYERS' GUIDE

Files, Hand

American Swiss File & Tool Co., Trumbull St., Elizabeth, N. J.

CARBORUNDUM CO., Niagara Falls, N. Y.

Delta File Works, Inc., 4837 James St., Philadelphia 37.

DISSTON, HENRY, & SONS, INC., 919 Tacony, Philadelphia 35.

Ford, M. A., Mfg. Co., 732 W. 1st St., Davenport, Iowa.

Hamilton Tool Co., Hamilton, Ohio.

Heller Bros., Mt. Prospect Ave., Newark, N. J.

Hoe, R., & Co., 138th St. at East River, New York

NEW BRITAIN GRIDLEY MCH. DIV., NEW BRITAIN MACHINE CO., South St., New Britain, Conn.

NICHOLSON FILE CO., Providence 1,

NORTON CO., Worcester, Mass.

PLUMB, FAYETTE R., INC., Tacony & Thompson St., Philadelphia.

SIMONDS SAW & STEEL CO., Safety Fund Bank Bldg., Fitchburg, Mass.

Filing Machines

Aro Equipment Corp., Erie Ave., Bryan, Ohio.

Chicago Pneumatic Tool Co., 8 E. 44th St., New York

Illinois Tool Works, 2513 N. Keeler Ave., Chicago.

Oliver Instrument Co., Adrian, Mich.

Oliver Machinery Co., Coldbrook St., Grand Rapids, Mich.

PRATT & WHITNEY DIV., NILES-BEMENT-POND CO., West Hartford 1, Conn.

Filters, Activated Carbon

Cochrane Corporation, 17th St. & Allegheny Ave., Philadelphia 32.

ATKINS, E. C., & CO., 402 S. Illinois St., Indianapolis,

Besley, Charles H., & Co., 135 N. Clinton St., Chicago,

Filters, Air

Air Devices, Inc., 17 E. 42nd St., New York 17

American Foundry Eqpt. Co. Inc., 412 S. Byrkit St., Mishawaka, Ind.

Blake, Edward, Co., 634 Commonwealth Ave., Newton Centre 59, Mass.

Carborundum Co., Refractories Div., Perth Amboy, N. J.

Chicago Pneumatic Tool Co., 8 E. 44th St., New York 17.

Cochrane Corporation, 17th St., & Allegheny Ave., Philadelphia 32.

CUNO ENGINEERING CO., 153 S. Vine St., Meriden, Conn.

Eimco Corp., 636 S. 4th St., Salt Lake City 8, Utah.

Knox., Earl E., Co., 8 West 2nd St., Erie, Pa.

Metallizing Engineering Co., 38-14 30th St., Long Island City 1, N. Y.

MICHIANA PRODUCTS CORP., Michigan City, Ind.

Milwaukee Metal Spinning Co., 4122 W. State St., Milwaukee 8.

Moraine Products Division, General Motors Corporation, 1420 Wisconsin Boulevard, Dayton 1, Ohio.

Parsons Engineering Corp., 2549 E. 79th St., Cleveland 4.

Schrader's Son, A., Div. of Scovill Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn.

STANDARD ELECTRICAL TOOL CO., 2505 River Rd., Cincinnati 4.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, East Pittsburgh, Pa.

Filters, Anthracite

Cochrane Corporation, 17th St., & Allegheny Ave., Philadelphia 32.

BUYERS' GUIDE

Filters, Electroplating

Alsop Engineering Corp., Milldale, Conn.

Beam-Knodel Co., 195 Lafayette St., New York 12.

Cochrane Corporation, 17th St., & Allegheny Ave., Philadelphia 32.

CUNO ENGINEERING CO., 153 South Vine St., Meriden, Conn.

Enthone, Inc., 442 Elm St., New Haven 11, Conn.

General Ceramics & Steatite Corporation, Keasbey, N. J.

HANSON-VAN WINKLE MUNNING CO., Matawan, N. J.

Industrial Filter & Pump Mfg. Co., 1621-25 W. Carroll Ave., Chicago 12.

Nankervis, Geo. L., Co., 5442 Second Blvd., Detroit 2.

Sommers Bros. Manufacturing Co., 3439-41-43 No. Broadway, St. Louis 7.

Stevens, Frederic B., Inc., 510 Third St., Detroit 26.

Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

Filters, Magnetic

STEARNS MAGNETIC MFG. CO., 635 So. 28th St., Milwaukee 4.

Filters, Oil

Adams, R. P., & Co.

Alsop Engineering Corp., Milldale, Conn.

Bowser, Inc., Fort Wayne 2, Ind.

Briggs Filtration Co., River Rd. & B & O R R., Bethayres, Md.

Burt Mfg. Co., 920 S. High St., Akron 11, Ohio

Cochrane Corporation, 17th St., & Allegheny Ave., Philadelphia 32.

CUNO ENGINEERING CO., 153 South Vine St., Meriden, Conn.

Hilliard Corp., 102 W. Fourth St., Elmira, N. Y.

Honan-Crane Corp., 1200 Indianapolis Ave., Lebanon, Ind.

Industrial Filter & Pump Mfg. Co., 1621-25 W. Carroll Ave., Chicago 12.

MICHIANA PRODUCTS CORP., Michigan City, Ind.

Moraine Products Division, General Motors Corporation, 1420 Wisconsin Boulevard, Dayton 1, Ohio.

Sommers Bros. Manufacturing Co., 3439-41-43 No. Broadway, St. Louis 7.

Zurn, A. J., Mfg. Co., Erie, Pa.

Filters, Pressure

Cochrane Corporation, 17th St., & Allegheny Ave., Philadelphia 32.

Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

Filters, Sand

Cochrane Corporation, 17th St., & Allegheny Ave., Philadelphia 32.

Ottawa Silica Co., Ottawa, Ill.

Filters, Solvent

ADAMS, R. P., CO., INC., 73 Chicago St., Buffalo 4, N. Y.

Alsop Engineering Corp., Milldale, Conn.

Black Sivalls & Bryson, Inc., 7500 E. 10th St., Kansas City 3, Mo.

Bowser, Inc., Fort Wayne 2, Ind.

Briggs Filtration Co., River Rd. & B & O R R., Bethayres, Md.

Cochrane Corporation, 17th St. & Allegheny Ave., Philadelphia 32.

Honan-Crane Corp., 1200 Indianapolis Ave., Lebanon, Ind.

Industrial Filter & Pump Mfg. Co., 1621-25 W. Carroll Ave., Chicago 12.

BUYERS' GUIDE

Filters, Water

ADAMS, R. P., C., INC., 73 Chicago St., Buffalo 4, N. Y.

Alsop Engineering Corp., Milldale, Conn.

Carborundum Co., Refractories Div., Perth Amboy, N. J.

Cochrane Corporation, 17th St. & Allegheny Ave., Philadelphia 32.

Condenser Service & Engineering Co., Inc., 95 River Street, Hoboken, N. J.

CUNO ENGINEERING CO., 153 South Vine St., Meriden, Conn.

Illinois Water Treatment Co., 840 Cedar St., Rockford, Ill.

Industrial Filter & Pump Mfg. Co., 1621-25 W. Carroll Ave., Chicago 12.

Moraine Products Division, General Motors Corporation, 1420 Wisconsin Boulevard, Dayton 1, Ohio.

Parsons Engineering Corp., 2549 E. 79th St., Cleveland 4.

Red Jacket Mfg. Co., Davenport, Iowa.

Zurn, A. J., Mfg. Co., Erie, Pa.

Filters, Vacuum

Eimco Corp., 636 S. 4th St., Salt Lake City 8, Utah

Finishes, Anti-Corrosive

ALLIED RESEARCH PRODUCTS, INC., 4004 E. Monument St., Baltimore 5, Md.

American Chemical Paint Co., Ambler, Pa.

Arco Co., 7313 Bessemer Ave., Cleveland 4.

Chemical Corp., The, Springfield, Mass.

Enthone, Inc., 442 Elm St., New Haven 11, Conn.

Frost Paint & Oil Corp., 1209 N. E. Tyler St., Minneapolis 13.

GLIDDEN COMPANY, 11001 Madison Ave., Cleveland 2.

Heil Process Equipment Corp., 12901 Elmwood Ave., Cleveland 11.

Metallizing Engineering Co., 38-14 30th St., Long Island City 1, N. Y.

Mitchell-Bradford Chemical Co., 2446 Main Street, Stratford Post Office, Bridgeport, Conn.

PARKER RUSTPROOF CO., 2186 E. Milwaukee Ave., Detroit 11, Mich.

PENNSYLVANIA SALT MFG. CO., 1000 Widener Bldg., Philadelphia 7.

Rheem Research Products, Inc., 4004 E. Monument St., Baltimore 5, Md.

Standard Varnish Works, 2600 Richmond Terr., Port Richmond 3, S. I., N. Y.

Technic Inc., 39 Snow St., Providence 3, R. I.

Thompson & Co., 1085 Allegheny Ave., Oakmont, Pa.

U. S. STONEWARE CO., PROCESS EQUIP. DIV., P. O. Box 350, Akron, Ohio.

Finishing Systems, Surface

GLIDDEN COMPANY, 11001 Madison Ave., Cleveland 2.

Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19.

Standard Varnish Works, 2600 Richmond Terr., Port Richmond 3, S. I., N. Y.

SURFACE CHECKING GAGE CO., 1937 Taft Ave., Hollywood 28, Calif.

Thompson & Co., 1085 Allegheny Ave., Oakmont, Pa.

UNITED CHROMIUM, INC., 51 East 42nd St., New York 17.

U. S. STONEWARE CO., PROCESS EQUIP. DIV., P. O. Box 350, Akron, Ohio.

Fire Brick (See Brick, Refractory)

Fire Extinguishers

Allied Weld-Craft, Inc., 401 W. South St., Indianapolis 4, Ind.

American-LaFrance-Foamite Corp., Elmira, N. Y.

Duplicates precision work automatically

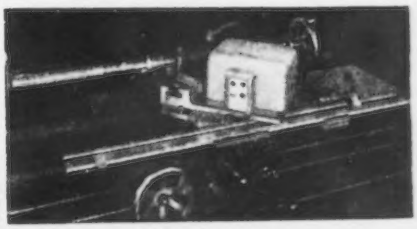
Shaft Volume Increased With Electric Duplicator

Shaft production has been increased five times by a new electric duplicating attachment recently introduced by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. This new device, which operates on the template-tracer principle, has cut machining time from 30 minutes to 6 on one job alone. It is excellent for profile facing as well.

The new duplicator can be installed in ten minutes on any Regal or Dual Drive without drilling or fitting, and can be plugged into the nearest light socket. It is controlled by electric push buttons.

It brings automatic sizing to Regals and Dual Drives, and will perform every duplicating function with accuracy of .0015" to .002".

For full information on this time- and labor-saving device, send for bulletin EC-1. The R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio.



(Advertisement)

Beals, McCarthy & Rogers, Inc., (Distributors), 50 Terrace, Buffalo 5, N. Y.

Bowser, Inc., Fort Wayne 2, Ind.

General Fire Truck Corp., 2272 E. Jefferson Ave., Detroit 7.

Industrial Products Co., 2746 N. 4th St., Philadelphia 33.

Mathieson Alkali Works, Inc., 60 E. 42nd St., New York 17.

Pressurelube, Inc., 609 W. 134th St., New York 31.

Fire Fighting Equipment

American-LaFrance-Foamite Corp., Elmira, N. Y.

American-Marsh Pumps, Inc., 60 Maple St., Battle Creek, Mich.

Bowser, Inc., Fort Wayne 2, Ind.

General Fire Truck Corp., 2272 E. Jefferson Ave., Detroit 7.

Grinnell Company, Inc., 260 West Exchange St., Providence 1, R. I.

Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh.

Zurn, A. J., Mfg. Co., Erie, Pa.

Fittings, Pipe

Dart, E. M., Mfg. Co., Providence 5, R. I.

Giberson, E. D., & Co., Inc., 58-30 57th St., Maspeth, L. I., N. Y.

Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7.

Jefferson Union Co., 601 W. 26th St., New York 1.

LADISH DROP FORGE CO., Dept. 1A-46, Cudahy, Wis.

Stockham Pipe Fittings Co., 4100 Tenth Ave. N., Birmingham 2, Ala.

Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90.

Weatherhead Co., 300 E. 13th St., Cleveland 8.

Fixtures (See Jigs and Fixtures)

Flame Cutting Equipment

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17.

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York 17.

MODERN ENGINEERING CO., 3405 W. Pine Blvd., St. Louis 3.

NATIONAL CYLINDER GAS CO., 840 N. Michigan Ave., Chicago 11.

Flame Hardening Equipment

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17.

Bowser, Inc., Fort Wayne 2, Ind.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn. & 344 Vulcan St., Buffalo 7, N. Y.

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York 17.

MODERN ENGINEERING CO., 3405 W. Pine Blvd., St. Louis 3.

NATIONAL CYLINDER GAS CO., 840 N. Michigan Ave., Chicago 11.

Flameproofing Compounds

Bakelite Corporation, 300 Madison Ave., New York 17.

Flanging Machines

Dart, E. M., Mfg. Co., Providence 5, R. I.

Jefferson Union Co., 601 W. 26th St., New York 1.

KANE & ROACH, INC., Syracuse, N. Y.

LADISH DROP FORGE CO., Dep. 1A-46, Cudahy, Wis.

Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90.

Flats, Cold-Drawn Steel

AMERICAN STEEL & WIRE CO., Rockefeller Bldg., Cleveland 13.

Flint

Whittaker, Clark & Daniels, Inc., 260 W. Broadway, New York 13.

Flooring, Plant

ALAN WOOD STEEL CO., Conshohocken, Pa.

Baron Steel Co., 4075 Detroit Ave., Toledo 12, Ohio.

Beals, McCarthy & Rogers, Inc., (Distributors), 50 Terrace, Buffalo 5, N. Y.

BETHLEHEM STEEL CO., Bethlehem, Pa

CENTRAL STEEL & WIRE CO., 3000 W. 51st St., Chicago 32.

Columbia Steel Co., Russ Bldg., San Francisco 6.

Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30.

Glazer Steel Corp., 2103 Ailor Ave., Knoxville, Tenn.

HOLLIDAY, W. J., & CO., Polk Blvd. & Wabash Ave., Hammond, Ind.

Indianapolis Machy. & Sup. Co. (Distributors), 1959-69 S. Meridian St., Indianapolis 6, Ind.

Midwest Steel Corp., Box 271, Charleston 21, W. Va.

Steel Sales Corp., 3352 S. Pulaski Rd., Chicago 23.

SIMULATED LANDING: *This 40-ft steel tower at a Burbank, Calif., airplane plant is used for testing shock on landing gear by dropping them on a concrete base. Lead weights above the wheels help to simulate actual conditions. The wheels are also spun backward before the drop and smoke can be seen rising from the skidding tires as they hit the base.*

THE NATION STANDS a good chance of slipping on a living room rug and falling flat on its face, if a safety survey of a half-million school children is any indication.

Conducted by the Greater New York Safety Council, the survey gave the youngsters a series of safety situations to check—to see if they were followed in individual homes. Number one hazard, among those listed, was small rugs on slippery floors, not tacked down and not made skidproof.

Last year the survey—one of the largest conducted in the country — showed the ... was improper ... mable materia... line, kerosene a...

Second most ... the children sai... bers of their ... doors and bure... diately after y... surprising nu... ies, the safety...

In third pla... mable liquids ... ing, and in the ... of sturdy bases ... on when reachi...

Families w... in leaving ma... small children...

The childre... windows unsc... could fall out) ... ported a bump... electric cords ... starters.

Explosion ... Down Base...

A heater e... the basement a...

Mrs. Reec... out of her cha... on the first ... foot of the ... floor. A phy... bruises and sh...

The oil heate... blast knocke... between the b... and tore the g... hinges. The kit... ripped loose.

The dining ... knocking over ... were called, b... flames.

Jap Croc... First Ti...

Ship manifes... Maritime Exch... the arrival he... ware for the ... war.

The Norwe... brought 30 ca... well as 32 cas... necklaces.

The British ... brought 4,500 cases of sheet rubber from Batavia, Netherlands East Indies.

EXPENDITURES for maintenance and repair of existing buildings are expected to total about $6 billion in 1948, about the same figure as in 1947, according to a forecast prepared by the economists of Producers' Council, David S. Miller, Council president, stated today. The Producers' Council, Inc., is a national organization of manufacturers of building materials and equipment.

"With repair work included, the total volume of all building next year, including new construction, is expected to approximate $20 billion," Dr. Mil... said.

The co... 000 gallon... and used ... said. The... has been ... the use o... cubic fee... kitchen ra...

The co... the U. S. ... tankers t... oil here ... bought in... company ... being pro... Coast.

City ice... ge at ... compa... of 500,... plant.

...e mo...

Seag... ts said t... hy sudde... be a sl... seasona...

...la's mo... more ... whistle... d villa... n oil ... Warren ... ported ... 41 belo... he Stat... e, a tin... 35 belo... ton Stat... d an u... below ... in Willi...

...y.

..., the M... s of ice ... of coal.

...en in ... ted that ... least fi... he ice a...

...sure s... hrough... ty with... n at th... with fr...

...ast, te... elow fr... ig but ...

...above, ... rowded.

...es

...re tak... morrow ... cere... ving of ...ent in ...

...ongress ...nuel C. ...itizens ...st Co., ...'s 7th ...le.

...at Inde... featured ...

Ba... ...erous armory fire more than 10 years ago.

Emergency squads of police were summoned to handle spectators who

BUYERS' GUIDE

Blaw-Knox Co., Farmer's Bank Bldg., Pittsburgh.

Borden Metal Products Co., P. O. Box 172, Elizabeth, N. J.

CARNEGIE-ILLINOIS STEEL CORP., Carnegie Bldg., 434 5th Ave., Pittsburgh 30.

FLEXROCK CO., 36th & Filbert Sts., Philadelphia 4.

Foundry Rubber, Inc., 1050 30th St. N. W. Washington 7, D. C.

Goodyear Tire & Rubber Co., Akron 16, Ohio.

HENDRICK MFG. COMPANY, 37 Lundaff St., Carbondale, Pa.

Jennison-Wright Corp., Kreolite Bldg., Toledo 1, Ohio.

Klemp, William & Co., 6601 S. Melvina Ave., Chicago 38.

KOPPERS COMPANY, INC., Koppers Bldg., Pittsburgh 19.

NUKEM PRODUCTS CORPORATION, Buffalo 20, N. Y.

Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis 4, Ind.

Stonhard Company, Terminal Commerce Bldg., Philadelphia 8.

Tremco Mfg. Co., 8710 Kinsman Rd., Cleveland 4.

U. S. STONEWARE CO., PROCESS EQPT. DIV., P. O. Box 350, Akron, Ohio.

Fluorspar

Aluminum Ore Co., 2156 Gulf Bldg., Pittsburgh.

AMERICAN CYANAMID CO., INDUS. CHEM. DIV., 30 Rockfeller Plaza, New York.

Baker, J. T., Chemical Co., N. Phillipsburg, N. J.

Balfour, Guthrie & Co., 355 California Ave., San Francisco.

Eagle Flurospar Co., Salem, Ohio.

Harshaw Chemical Corp., E. 97th St., Cleveland.

INLAND STEEL CO., 38 S. Dearborn St., Chicago 3.

Lavino, E. J., & Co., Plymouth Meeting, Pa.

Mahoning Mining Co., Rosiclare, Ill.

Shattuck Denn Mining Corp., 120 Broadway, New York.

Flux, Brazing (See Brazing Flux)

Flux Foundry (See Foundry Flux)

Flux, Openhearth and Electric Furnace

PITTSBURGH PLATE GLASS CO., PAINT DIV., Pittsburgh 19.

Flux, Silver Solder (See Silver Soldering Flux)

Flux, Welding (See Welding Flux)

Forging Equipment

AJAX MFG. CO., Euclid Branch P. O., Cleveland 17, Ohio.

Bradley, C. C., & Son, Inc., Syracuse, N. Y.

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa.

ERIE FOUNDRY CO., Erie, Pa.

LOBDELL CO., Wilmington 99, Del.

WATERBURY-FARREL FOUNDRY & MACHINE CO., Waterbury, Conn.

Forging Presses (See Presses Forging and Coining)

Forging Rolls

Blaw-Knox Company, Pittsburgh, Pa.

Donahue Steel Products Co., Inc., 1919 W. 74th St., Chicago 36.

Galbreath Machinery Co. (Distributors), Empire Bldg., Pittsburgh.

HEPPENSTALL CO., Hatfield St., Pittsburgh 1.

Miles Machinery Co., 2025 E. Genesee Ave., Saginaw, Mich.

NATIONAL FORGE & ORDNANCE CO., Irvine, Warren Co., Pa.

Ritterbush & Co., Inc., 50 Church St., New York 7.

West Penn Machinery Co., 1210 House Bldg., Pittsburgh 22.

Williams White & Co., 8th St. & Third Ave., Moline, Ill.

Forgings, Alloy and Carbon Steel

Aircraft Machines Inc., Colorado Springs, Colo.

Ajax Steel & Forge Co., 205 Adair St., Detroit 7.

ALLEGHENY LUDLUM STEEL CORP., Brackenridge, Pa.

ALLIED PRODUCTS CORP., 4665 Lawton Ave., Detroit 8.

Alliance Drop Forging Co., P. O. Box 427, Alliance, Ohio.

ALLIS-CHALMERS MFG. CO., 1126 S. 70th St., Milwaukee 1.

AMERICAN BRAKE SHOE CO., CASTINGS, 230 Park Ave., New York 17.

American Car & Foundry Co., 30 Church St., New York 8.

AMERICAN CHAIN & CABLE CO., Wilkes-Barre, Pa.

American Forge Div., American Brake Shoe Co., 332 S. Hayne Ave., Chicago 8.

American Forge Co., 735 Ashley Ave., Berkeley, Cal.

American Hollow Boring Co., Erie, Pa.

ATLAS DROP FORGE CO., 209 W. Mount Hope Ave., Lansing 2, Mich.

Atwater Mfg. Co., Plantsville, Conn.

BALDT ANCHOR, CHAIN & FORGE DIV., BOSTON METALS CO., 6th St., P. O. Box 350, Chester, Pa.

BARIUM STEEL & FORGE INC., Allen St., Canton 1, Ohio.

Bay City Forge Co., Cranberry St., Erie, Pa.

Beals, McCarthy & Rogers, Inc., 50 Terrace, Buffalo 5, N. Y.

BETHLEHEM STEEL CO., Bethlehem, Pa.

BILLINGS & SPENCER CO., Laurel St., Hartford 6, Conn.

Blakeslee Forging Co., Main St., Plantsville, Conn.

Bonney Forge & Tool Works, Allentown, Pa.

Brewer-Titchaer Corp., Cortland, N. Y.

Brown-Wales Co., 493 C. St., Boston 10.

Buckeye Forging Co., Harvard Ave., Cleveland 5.

Burke Steel Co., Sherer St., Rochester 2, N. Y.

CAINE STEEL CO., 1830 No. Central Ave., Chicago 39.

Cann & Saul Steel Co., 516 Commerce St., Philadelphia 6.

Camden Forge Co., Mt. Ephram St. & Atlantic City R.R., Camden, N. J.

CANTON DROP FORGING & MFG. CO., Canton, Ohio.

CARNEGIE-ILLINOIS STEEL CORP., 434 5th Ave., Pittsburgh 30.

CARPENTER STEEL CO., Bern St., Reading, Pa.

Champion Machine & Forging Co., 3695 E. 78th St., Cleveland.

CLAPP, E. D., MFG. CO., 305 Genesee St., Auburn, N. Y.

Cleveland City Forge Co., 4501 Lakeside Ave., Cleveland.

Cleveland Hardware & Forging Co., 3270 E. 79th St., Cleveland.

Clifford-Jacobs Forging Co., Box 330 Champaign, Ill.

BUYERS' GUIDE

Columbus Anvil & Forging Co., 115 W. Frankfort St., Columbus 16.

Columbia Steel Co., Russ Bldg., San Francisco 6.

Columbus Bolt Works Co., 291 Marconi Blvd., Columbus 16.

Columbus Forge & Iron Co., 544 W. First Ave., Columbus, Ohio.

Colonial Steel Division, Vanadium-Alloys Steel Co., Latrobe, Pa.

Cornell Forge Co., 6667 W. 66th St., Chicago 38.

Crucible Steel Co. of America, 405 Lexington Ave., New York.

Davenport Beiser Corp., 2305 Rockingham Rd., Davenport, Iowa.

Dayton Forging & Heat Treating Co., First St., Dayton, Ohio.

Delaware Alloy Forge Co., 2300 E. Tioga St., Philadelphia.

Dresser Mfg. Div., Bradford, Pa.

Drop Dies & Forgings Co., 3097 E. 61st St., Cleveland.

Duff-Norton Mfg. Co., 2709 Preble Ave., Pittsburgh 30.

DYSON, JOSEPH, & SONS, INC., 5423 St. Clair Ave., Cleveland 14.

Eimco Corp., 636 S. 4th St., Salt Lake City 8, Utah.

Ellwood City Forge Co., Box 590, Ellwood City, Pa.

Endicott Forging & Mfg. Co., Endicott, N. Y.

Fairmount Tool & Forging Co., 10611 Quincy Ave., Cleveland 6.

Falleen Drop Forge Co., Filer City, Mich.

Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago

Forging & Casting Div., Allegheny Ludlum Steel Corp., Ferndale, Mich.

Forgings & Stampings, Inc., 23rd Ave., Rockford, Ill.

Gardiner Mfg. Co., Union St., Oakland 7, Cal.

General Drop Forge Div., Brown-Lipe Gear Co., Elmwood Ave., Buffalo 7, N. Y.

General Metals Corp., Liberty St., P. O. Box 198 Houston 1, Tex.

Giant Grip Mfg. Co., Oshkosh, Wis.

Globe Forge Inc., Peat St., Syracuse, N. Y.

Green Bay Drop Forge Co., S. State St., Green Bay, Wis.

Hammond & Irving Inc., North St., Auburn, N. Y.

HARRISBURG STEEL CORP., 10th St., Harrisburg, Pa.

Harris-Thomas Drop Forge Co., Harshman St., Dayton, Ohio.

Harvey Mfg. Co., 17th St., Racine, Wis.

Henry & Allen, Inc., 36 Wadsworth St., Auburn, N. Y.

HEPPENSTALL CO., 4622 Hatfield St., Pittsburgh 1.

HERBRAND DIV. BINGHAM-HERBRAND CORP., 240 Kensington St., Fremont, Ohio.

Horst Manufacturing Co., 12675 Haggerty Road, Belleville, Mich.

Hoyland Steel Co. Inc., 405 Lexington Ave., New York 17.

Indianapolis Drop Forging Co., 1300 Madison Ave., Indianapolis 7, Ind.

Indiana Forge & Machine Co., Indiana Harbor Station, East Chicago, Ill.

Interstate Drop Forge Co., 4050 N. 27th St., Milwaukee.

Isaacson Iron Works, 2917 E. Marginal Way, Box 3028, Seattle 14.

Jersey City Forging Works, 803 Jersey Ave., Jersey City, N. J.

JESSOP STEEL CO., Washington, Pa.

Johnson Forge & Machinery Co., Inc., Mishawaka, Ind.

Johnston & Jennings Co., 877 Addison Rd., Cleveland 14.

Jorgenson, Earle M., Co., Box 2358, Terminal Annex, Los Angeles 54.

Knowles, F. S., 77 W. Washington St., Suite 1702, Chicago 2.

KOPPERS CO., INC., Koppers Bldg., Pittsburgh 19.

Kortick Mfg. Co., 345 1st St., San Francisco.

Kreuter & Co., Inc., 585 18th Ave., Newark 5, N. J.

Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.

LADISH DROP FORGE CO., Dept. 1A-46, Cudahy, Wis.

Lakeview Forge Co., Pittsburgh Ave., Erie, Pa.

LAMSON & SESSIONS CO., 1971 W. 85th St., Cleveland 2.

LANSING DROP FORGE CO., Logan St., Lansing, Mich.,

Larson, Charles E., & Sons Inc., 2645 N. Keeler Ave., Chicago 39.

LATROBE ELECTRIC STEEL CO., Latrobe, Pa.

Laughlin, Thomas, Co., Fore St., Portland, Me.

Leard, William, Co., Inc., New Brighton, Pa.

McKair-Hatch Inc., 125 Skillen St., Buffalo

Melling Forging Co., 1401 Case St., Lansing, Mich.

MERRILL BROS., 56-22 Arnold Ave., Maspeth, L. I., N. Y.

MESTA MACHINE CO., Box 1466 Pittsburgh.

Michigan Forging Co., 4010 W. Jefferson Ave., Detroit 9.

MIDVALE CO., Nicetown, Philadelphia.

Milwaukee Forge & Machine Co., E. Oklahoma Ave., Milwaukee 7.

Mitchell Steel Co., Stockyards Station, Cincinnati.

Moline Forge Inc., 4101 4th Ave., Moline, Ill.

Mondi Forge Co., Inc., 10310 Berea Rd., Cleveland.

Moore Drop Forging Co., 36 Walte. St., Springfield, Mass.

NATIONAL FORGE & ORDNANCE CO., Irvine, Warren County, Pa.

NATIONAL LOCK WASHER CO., 40 Hermon St., Newark 5, N. J.

Octigan Forge & Mfg. Co., 2428 St. Lowe Ave., Chicago 16.

Ohio Forge & Machine Corp., 3010 Woodhill Rd., Cleveland 4.

OLIVER IRON & STEEL CORP., S. 10th St., Pittsburgh.

Owensboro Forging Co., Owensboro, Ky.

Pacific Car & Foundry Co., Renton, Washington.

Park Drop Forge Co., 777 E. 79th St., Cleveland.

Paterson Steel & Forge Co., 1410 Stratford Ave., Conn.

Peterson Steels, Inc., 420 Lexington Ave., New York 17.

Phoenix Mfg. Co., Front St., Catasauqua, Pa.

Pettibone Mulliken Corp., 4710 W. Division St., Chicago.

Pittsburgh Forgings Co., Riverside Drive, Jackson, Mich.

Pittsburgh Forgings Co., Thorne St., Corapolis, Pa.

Pittsburgh Trolley & Forge Co., 117 Water St., Pittsburgh.

Poor & Co., Canton Forge & Axle Works, 2027 Dueber Ave., Canton, Ohio.

Porter Forge & Furnace, Inc., Ashland St., Everett, Mass.

Portland Forge & Foundry Co., Portland, Ind.

Rhode Island Tool Co., W. River St., Providence, R. I.

BUYERS' GUIDE

ROCKFORD DROP FORGE CO., 2030 9th St., Rockford, Ill.

St Paul Foundry & Mfg. Co., St. Paul, Minn.

SALEM TOOL CO., S. Ellsworth Ave., Salem, Ohio.

Schuler Axle Co., Inc., S. Second St., Louisville, Ky.

Shank Mfg. Co., Bucyrus, Ohio.

Smith-Armstrong Forge, Inc., Marquette Rd., Cleveland.

Snell Mfg. Co., Washington St., Worcester, Mass.

Southern Saw Works, Inc., E. Point Rd., Atlanta

Spencer Mfg. Co., Spencer, Ohio.

Standard Forgings Corp., Railway Exchange Bldg., Chicago 4.

Standard Steel Works Div., Baldwin Locomotive Works, Eddystone, Pa.

Steel, R., & Sons, Inc., 4221 9th St., Long Island City 1, N. Y.

Steel Improvement & Forge Co., 970 E. 64th St., Cleveland 14.

Storma Drop Forging Co., P. O. Box 2050 Springfield, Mass.

Struthers Wells Corp., Titusville Forge Div., Titusville, Pa.

SWEDISH AMERICAN STEEL CORP., 443 Kent Ave., Brooklyn 11.

Taylor Forge & Pipe Works, P. O. Box 485 Chicago.

TAYLOR-WHARTON IRON & STEEL CO., Easton, Pa.

TRANSUE & WILLIAMS STEEL FORGING CORP., Alliance, Ohio.

TUBE TURNS, INC., E. Broadway, Louisville

Uddeholm Company of America, Inc., 155 East 44th Street, New York 17.

Union Forging Co., Endicott, N. Y.

Unit Drop Forge Div., Fuller Mfg. Co., S. 62nd St., West Allis, Wis.

Vichek Tool Co., 3001 E. 87th St., Cleveland

Vulcan Steam Forging Co., 237 Rano St., Buffalo 7.

WHEELOCK-LOVEJOY & CO., INC., 126 Sidney St., Cambridge 39, Mass.

Wilcox Mfg. Co., Chestnut St., Mechanicsburg Pa.

WILLIAMS, J. H., & CO., Vulcan St., Buffalo.

Wyman-Gordon Co., Worcester.

Forgings, Aluminum

Accurate Brass Co., Inc., 73rd Ave., Glendale, Brooklyn 27.

ALUMINUM CO. OF AMERICA, 2185 Gulf Bldg., Pittsburgh 19.

AMPCO METAL, INC., 1745 So. 38th St., Dept. 1A-1, Milwaukee 4.

BOHN ALUMINUM & BRASS CORP., 1400 Lafayette Bldg., Detroit.

CANTON DROP FORGING & MFG. CO., Canton, Ohio.

DYSON, JOSEPH, & SONS, INC., 5123 St. Clair Ave., Cleveland 14.

HARRISBURG STEEL CORP., 10th and Herr Sts., Harrisburg, Pa.

Harvey Metal Corp., 74th & Ashland Ave., Chicago 36.

Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7.

Knowles, F. S., 77 W. Washington St., Suite 1702, Chicago 2.

LAMSON & SESSIONS CO., 1977 W. 85th St., Cleveland 2.

Lansing Drop Forge Co., Logan St., Lansing, Mich.

McKair-Hatch Inc., Skillen St., Buffalo 7.

MERRILL BROTHERS, 56-22 Arnold St., Maspeth, L. I., N. Y.

Mueller Brass Co., Lapeer Ave., Port Huron, Mich.

PERMANENTE PRODUCTS CO., Kaiser Bldg., Oakland, Calif.

REVERE COPPER & BRASS, INC., 230 Park Ave., New York 17.

REYNOLDS METALS CO., Aluminum Div. Louisville 1.

Rome Mfg. Div., Revere Copper & Brass, Inc., Rome, N. Y.

Scovill Mfg. Co., Waterbury, Conn.

Storms Drop Forging Co., P. O. Box 2050, Springfield, Mass.

WILLIAMS, J. H., & CO., Vulcan St., Buffalo.

Wyman Gordon Co., Worcester

Forgings, Brass, Bronze, Copper

Accurate Brass Co., Inc., 73rd Ave., Glendale, Brooklyn 27.

AMERICAN BRASS CO., New York City.

AMPCO METAL INC., 1745 S. 38th St., Dept. 1A-1, Milwaukee.

BILLINGS & SPENCER CO., Laurel St., Hartford 6

BOHN ALUMINUM & BRASS CORP., 1400 Lafayette Bldg., Detroit.

Brewer-Titchener Corp., P. O. Box 832, Cortland, N. Y.

Buckeye Forging Co., 10001 Harvard Ave., Cleveland 5.

Canton Drop Forging & Mfg. Co., Canton, Ohio.

Chase Brass & Copper Co., Inc., Grand St., Waterbury, Conn.

CLAPP, E. D., MFG. CO., 305 Genesee St., Auburn, N. Y.

Cleveland Hardware & Forging Co., 3270 E. 79th St., Cleveland.

Delaware Alloy Forge Co., 2300 E. Tioga St., Philadelphia.

Duff-Norton Mfg. Co., 2709 Preble Ave., Pittsburgh 30.

Endicott Forging & Mfg. Co., Endicott, N. Y.

General Metals Corp., Liberty Rd., P O. Box 198 Houston 1

HARRISBURG STEEL CORP., 10th and Herr Sts., Harrisburg, Pa.

Harvey Metal Corp., 74th St. & Ashland Ave., Chicago 36.

Indianapolis Drop Forging Co., 1300 Madison Ave., Indianapolis 7

Keystone Forging Co., Northumberland, Pa.

KNOWLES, F. S., 77 W. Washington St., Suite 1702, Chicago 2.

KOPPERS CO., INC., Koppers Bldg., Pittsburgh 19.

Kraeuter & Co., Inc., 585 18th Ave., Newark 3, N. J.

Kropp Forge Co., 5301 W. Roosevelt Ave., Chicago.

Larson, Charles E., & Sons, Inc., 2645 N. Keeler Ave., Chicago 39.

MALLORY, P. R., & CO., INC., 3029 E. Washington St., Indianapolis 6

MERRILL BROTHERS, 56-22 Arnold St., Maspeth, L. I., N. Y.

McKair-Hatch, Inc., Skillen St., Buffalo 7.

Muller Brass Co., Lapeer Ave., Port Huron, Mich.

Phoenix Mfg. Company, Joliet, Ill.

REVERE COPPER & BRASS, INC., 230 Park Ave., New York 17.

Rhode Island Tool Co., 148 W. River St. Providence 1

Rome Mfg. Co., Div. Revere Copper & Brass Inc., Rome, N. Y.

Scovill Mfg. Co., Waterbury, Conn.

STEEL IMPROVEMENT& FORGE CO., 970 E. 64th St., Cleveland 14.

Storms Drop Forging Co., P. O. Box 2050, Springfield, Mass.

TITAN METAL MFG. CO., Bellefonte, Center Co., Pa.

TUBE TURNS, INC., E. Broadway, Louisville 1

Unit Drop Forge Div., Fuller Mfg. Co., S. 62nd St., West Allis, Wis.

Weiger Weed & Co., 11644 Cloversdale Ave., Detroit 4.

WILLIAMS, J. H., & CO., Vulcan St., Buffalo.

Forgings, Composite-Steel Die Sections

Ajax Steel & Forge Co., 205 Adair St., Detroit 7.

ALLEGHENY LUDLUM STEEL CORP., Brackenridge, Pa.

KNOWLES, F. S., 77 W. Washington St., Suite 1702, Chicago 2.

STEEL IMPROVEMENT & FORGE CO., 970 E. 64th St., Cleveland 14.

Forgings, Magnesium

ALUMINUM CO. OF AMERICA, 2185 Gulf Bldg., Pittsburgh 19.

AMERICAN MAGNESIUM CORP., Pittsburgh.

Dow Chemical Co., Midland, Mich.

Knowles, F. S., 77 W. Washington St., Suite 1702, Chicago 2.

McKair-Hatch, Inc., Skillen St., Buffalo 7.

MERRILL BROTHERS, 56-22 Arnold St., Maspeth, L. I., N. Y.

REVERE COPPER & BRASS, INC., 230 Park Ave., New York 17.

Rome Mfg. Co., Div. Revere Copper & Brass, Inc., Rome N. Y.

Forgings, SAE Steels

Ajax Steel & Forge Co., 205 Adair St., Detroit 7.

ALLEGHENY LUDLUM STEEL CORP., Brackenridge, Pa.

American Car & Foundry Co., 30 Church St., New York 8.

American Forge Div., American Brake Shoe Co., 2621 S. Hoyne Ave., Chicago 8.

ATLAS DROP FORGE CO., 209 W. Mt. Hope Ave., Lansing 2, Mich.

Baron Steel Co., 4075 Detroit Ave., Toledo 12,

BETHLEHEM STEEL CO., Bethlehem, Pa.

BILLINGS & SPENCER CO., Laurel & Park Sts., Hartford 6

Brewer-Titchener Corp., P. O. Box 832, Cortland, N. Y.

Brown-Wales Co., 493 C St., Boston 10.

CAINE STEEL CO., 1830 N. Central Ave., Chicago 39.

Camden Forge Co., Mt. Ephraim St. & Atlantic City R.R., Camden, N. J.

CARNEGIE-ILLINOIS STEEL CORP., Carnegie Bldg., 434 5th Ave., Pittsburgh 30.

Champion Machine & Forging Co., 3685 E. 78th St., Cleveland 5.

CLAPP, E. D., MFG. CO., 305 Genesee St., Auburn, N. Y.

Columbia Steel Company, Russ Bldg., San Francisco 6.

Eimco Corp., 636 S. 4th St., Salt Lake City 8, Utah.

HARRISBURG STEEL CORP., 10th and Herr Sts., Harrisburg, Pa.

HEPPENSTALL CO., 4622 Hatfield St., Pittsburgh 1.

Interstate Drop Forge Co., 4065 N. 27th St., Milwaukee 9.

Jorgenson, Earle M., Co., Box 2358, Terminal Annex, Los Angeles 54.

Knowles, F. S., 77 W. Washington St., Suite 1702, Chicago 2.

LADISH DROP FORGE CO., Dept. 1A-46, Cudahy, Wis.

McInnes Steel Co., Corry, Pa.